

University of Montana

ScholarWorks at University of Montana

Graduate Student Theses, Dissertations, &
Professional Papers

Graduate School

1985

Maps of national parks, their role and readability, or, "I got lost in Yellowstone"

Lakshmi Putran
The University of Montana

Follow this and additional works at: <https://scholarworks.umt.edu/etd>

Let us know how access to this document benefits you.

Recommended Citation

Putran, Lakshmi, "Maps of national parks, their role and readability, or, "I got lost in Yellowstone"" (1985).
Graduate Student Theses, Dissertations, & Professional Papers. 2926.
<https://scholarworks.umt.edu/etd/2926>

This Thesis is brought to you for free and open access by the Graduate School at ScholarWorks at University of Montana. It has been accepted for inclusion in Graduate Student Theses, Dissertations, & Professional Papers by an authorized administrator of ScholarWorks at University of Montana. For more information, please contact scholarworks@mso.umt.edu.

COPYRIGHT ACT OF 1976

THIS IS AN UNPUBLISHED MANUSCRIPT IN WHICH COPYRIGHT SUBSISTS. ANY FURTHER REPRINTING OF ITS CONTENTS MUST BE APPROVED BY THE AUTHOR.

MANSFIELD LIBRARY
UNIVERSITY OF MONTANA

DATE: 1985

MAPS OF NATIONAL PARKS: THEIR ROLE AND READABILITY

(Or, "I got lost in Yellowstone")

By Lakshmi Putran

B.Sc. University of Calcutta, 1981

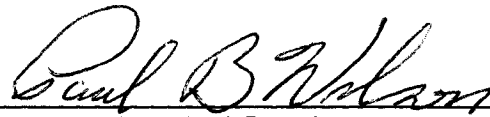
Presented in partial fulfillment of the requirements

for the degree of Master of Arts

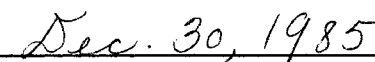
University of Montana

1985

Approved by


Chairman, Board of Examiners


Dean, Graduate School


Date

UMI Number: EP35712

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



UMI EP35712

Published by ProQuest LLC (2012). Copyright in the Dissertation held by the Author.

Microform Edition © ProQuest LLC.

All rights reserved. This work is protected against unauthorized copying under Title 17, United States Code



ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

Maps of National Parks: Their Role and Readability (140 pages)

Director: Paul B. Wilson

PW

The U.S. National Park Service produces millions of maps each year for distribution to visitors to the national parks. The maps are aimed at orienting visitors to the unfamiliar surroundings and also to provide information about the various facilities available in the parks.

The thesis mainly evaluates the readability of the national park map. The maps of the 13 national parks of the Rocky Mountain Region are considered for the study. The maps are diverse, varying from a simple representation of points of interest along the major roads in some park folders, to continuous surface information in multicolour productions. Some parks also use monochrome or duochrome versions of the multicolour map. Three maps, representing the simple park folders, the more complex park folders, and its duochrome version, are evaluated.

The study used a task-oriented approach where voluntary subjects answered a questionnaire developed for the purposes of evaluation. The tasks included locating, verifying, and interpreting the map symbols. The questionnaire also elicited reader opinions on the appearances and information content of the maps.

The results showed that the overall impressions of the park maps were favourable. Readability was fairly high, over 70% of the questions asked being answered correctly for each map. The larger multicolour map had a significantly higher readability than its duochrome version. A map reading acuity test was used to determine the individuals' ability to read maps and was correlated to the performances on the national park maps. There was only a weak relationship between the variables on the simpler form of the park map; previous map knowledge, however, seems to have been an aid when encountering the more complex versions of the park maps.

The readability seems to correlate to the legibility of the map elements. While the study does not propose a design concept for national park maps, it does suggest that more attention be paid in the current maps to the basics of graphic design: clear type, clear symbols, clean colour differentiation, and bolder visual contrast, to enhance its utility for the users.

Table of Contents

Abstract	ii
Table of Contents	iii
List of Figures	v
List of Tables	vi
Acknowledgements	vii
1. INTRODUCTION	1
2. THE NATIONAL PARKS	7
Area and Parks of Study	13
3. THE NATIONAL PARK MAPS	20
The Recreation Map	20
The function of the map	23
Information content	25
Communication of information	27
The National Park Maps	28
Role and function	30
Information content and graphic conception	32
Classification	35
4. RESEARCH DESIGN AND METHODOLOGY	42
The Objectives	42
The Survey Design	44
The maps selected	44
The survey sample	46
The survey design and methodology	47
Questionnaire Design	48
The Pretest: A Brief Summary, Conclusions and Modifications	50
The Main Survey	52
Analytical Procedures	53
5. ANALYSIS AND INTERPRETATION	54
Sample Characteristics	54
Student class standing	55
Major field of study	55
Eyesight	56
Previous training in map reading	56
Frequency of map use	57
Park visitation	58

The Map Reading Acuity Test	59
The Map Reading Groups	62
Park Map Evaluation	64
Appearance of the folders and maps	64
Symbol recognition	70
The readability of the park maps	72
The BNP map	73
The RMB and RMC maps	78
6. SUMMARY AND CONCLUSIONS	93
Summary	93
Conclusions	95
Appendix A. Survey Questionnaire	101
Appendix B. Scores and Statistics	129
Appendix C. User Experiences With National Park Maps	134
Selected Bibliography	136

List of Figures

Figure 1: Recreation Visits to Areas under the National Park System, 1983	12
Figure 2: Location of National Parks of the Study Area	15
Figure 3: Annual Visits to National Parks of the Study Area, 1983	18
Figure 4: A Generalized Communication System	27
Figure 5: Symbols used by the National Park Service	34
Figure 6: The Survey Design	48
Figure 7: Frequency Distribution of Map Reading Acuity Scores	61
Figure 8: Frequency Distribution of MRAT Scores in the Map Reading Groups.	62
Figure 9: Appearance Ratings for Folders and Maps	66
Figure 10: Frequency Distribution of Readability Scores for BNP	73
Figure 11: Correlation between Map Reading Acuity and Performance on the BNP Map	75
Figure 12: Frequency Distribution of Readability Scores for RMB and RMC	79
Figure 13: Correlation between Map Reading Acuity and Performance on the RMB Map	82
Figure 14: Correlation between Map Reading Acuity and Performance on the RMC Map	82
Figure 15: Percent Correct Identification of Physical Information	87
Figure 16: Percent Correct Identification of Cultural Information	88

List of Maps

- Map 1: Badlands National Park (BNP)**
- Map 2: Rocky Mountain National Park (RMB)**
- Map 3: Rocky Mountain National Park (RMC)**

List of Tables

Table 3-1:	Classification of the National Park Maps	40
Table 5-1:	Percentage of Sample with Instructions in Map Reading	56
Table 5-2:	Frequency of Map Use among the Sample	57
Table 5-3:	Visitation to the National Parks	59
Table 5-4:	Sectional and Total Range & Mean Scores (MRAT)	60
Table 5-5:	Selected Statistical Measures for the Map Reading Groups	63
Table 5-6:	Analysis of Variance for the Map Reading Groups	63
Table 5-7:	Mean Ratings for the Appearance of Folders and Maps	66
Table 5-8:	Percentage (number) of Sample Wishing to Visit the Parks	67
Table 5-9:	Sample Opinion of the Written Text in the Folders	69
Table 5-10:	Symbol Recognition (number of correct identifications)	71
Table 5-11:	Selected Statistical Measures for the BNP Map	73
Table 5-12:	Ease or Difficulty of Extraction of Information from the BNP Map	74
Table 5-13:	Rating for the Information Content of the BNP Map	76
Table 5-14:	Desired Changes in the BNP Map	77
Table 5-15:	Selected Statistical Measures for the RMB and RMC Maps	79
Table 5-16:	T-Test for the RMB and RMC Groups	80
Table 5-17:	T-Test for the RMB and RMC Maps	80
Table 5-18:	Ease or Difficulty of Extraction of Information from the RMB and RMC Maps	82
Table 5-19:	Ratings for the Information Content of the RMB and RMC Maps	84
Table 5-20:	Desired Changes in the RMB and RMC Maps	84

Acknowledgements

**To Every One Of You Who Helped
either by caring
or
by your indifference
Thanks**

Dedicated to:

The Mansfield Library

Chapter 1

INTRODUCTION

A tourist's phrase book is a guide to a strange verbal environment; his map is a guide to an unfamiliar physical environment.¹

Tourist maps undoubtedly belong to the most *popular* cartographic information media. The map is a tool which communicates both navigational and interpretive information about the environment; the map also has a distinctive advantage in that it is easier to draw an itinerary for a trip on a map than to plan one without it.

Today, outdoor recreation is the topic of concern in a number of diverse fields including economics, conservation, forestry, and sociology. The concern has been with user-resource relationships, recreational behaviour, preferences, and perceptions. Yet recreational tools (the map is certainly such a tool especially where the recreational resource is the environment) have seldom been the topic of research.

The scope of the medium of the map has been recognized in many diverse academic fields (geography, geology, hydrology, history, planning, and forestry to name a few). Research in cartography is experiencing rapid growth, but a need has

¹George F. McCleary Jr. and Nicholas Westbrook, "Rereational and Re-creational Mapping," paper presented at the 7th Technical Conference of the International Cartographic Association, Madrid, Spain, 1974.

been felt to examine the quality of mapping "as it is actually done rather than in the world of cartographic idealism."²

Despite the quantities of tourist maps produced in the country, there have only been a few studies concerning the design or effectiveness of these maps. Parsons, in his master's thesis, identified the role of the map in the recreation experience.³ Ward assessed the 48 available official state road maps of the country and suggested that the topic be researched by professional cartographers.⁴ The Seventh Technical Conference of the International Cartographic Association included papers on tourist cartography.⁵ Harrington, in discussing the tourist map of the United States, declared that it needed a great designer. He proposed a design concept for mapping the varied regions of the country and suggested that they follow some notable European maps.⁶ The study of road maps, town maps, and tourade maps seems to be the concern of European nations; in Harrington's list of excellence, the maps are all European.⁷ The term

²Judy M. Olson, "Comments on Research Trends," The American Cartographer 11, supplement (Summer 1984):68.

³John R. Parsons, "The Role of the Map in the Recreation Experience," (Master's thesis, University of Kansas, 1978).

⁴Albert W. Ward, "The State of State Road Maps," The American Cartographer 4 (1977):5-9.

⁵International Cartographic Association, International Yearbook of Cartography 15 (1975).

⁶Joseph D. Harrington, "The Tourist Map of the United States Needs a Great Designer," Proceedings of the American Congress on Surveying and Mapping, 34th Annual Meeting, St. Louis, MO., March 10-15, 1974, pp. 553-59.

⁷*Ibid.*, pp. 553-54.

'tourist cartography' in fact does not seem to exist in American cartographic literature.

The use of the map in tourism and recreation has increased rapidly over the years correlating to the increased number of participants in recreational activities in the country. The vast amount of land available for outdoor recreation, especially in the West, is largely a result of federal ownership. Yellowstone National Park was established in 1872; it initiated a process which resulted in giving the Federal Government the responsibility of maintaining for its people an extensive system of national recreation grounds. During the initial stages, the creation of the parks had little significance for the public. The parks were far from the populated East and only the adventurous few visited them. During the second decade of this century and more so after the Second World War, when changed conditions made for greater travel opportunities within the United States, these parks assumed a more prominent role. Today the national parks and other areas administered by the National Park Service (Department of the Interior) are the paramount objectives of motoring vacationists.⁸ In 1980 about 47 million people visited the 48 national parks in the country. In 1983 this had increased to more than 50 million people.⁹

It is important to realize that touring a national park is essentially a resource-oriented experience as opposed to an activity-oriented one. The environment provides the primary motivation--the direct interaction between the

⁸Clifford M. Zierer, "Tourism and Recreation in the West," The Geographical Review 42 (1952):474.

⁹U.S., Department of the Interior, National Park Service, National Park Statistical Abstracts, 1983 (Denver, Co.: Denver Service Center), Table 3, p. 6.

participant and the environmental resources being the principal focus of attention. This requires an understanding of the spatial environment on the part of the participant--the maps of the parks are interpretive, emphasizing site features. The unfamiliarity with the environment also calls for navigational information. The tourist map, therefore, has two basic purposes: (1) to convey on-site interpretive information and (2) to provide navigational information. Both of these help fill in the void created by a lack of extensive previous knowledge and experience.

A visitor to a park is naturally eager to gain some understanding of the things he observes. The National Park Service, in addition to having interpretive and educational programmes, distributes thousands of maps and brochures as a means towards this end. In spite of being such a popular information media, the park maps have received little or no attention from academic recreationists or cartographers alike. Any reference in park literature to maps is minimal; while interpretive tools such as signs and symbols, audio-visual techniques, and interpretive programmes have been studied, the map has remained neglected.¹⁰

The thesis basically aims to evaluate national park maps. However, such an evaluation is far from simple. The park map is part of a unique communication

¹⁰U.S., Department of the Interior, National Park Service and National Park and Recreation Association, Trends (April/May/June 1974). Trends is a quarterly publication of the Park Practice Program on topics of general interest in park and recreation management and programming. This particular issue subtitled 'Trends in Communication', deals with the various aspects of park communication methods: how to write a news release, procedures for illustrations and presentations, designing effective displays, graphic designing, park symbols, etc. The two page article on maps (pp. 32-33) is very generalized and does not refer to park maps in particular. The Park Practice Program also publishes two other quarterly publications: Grist, a publication on practical solutions to everyday problems in park and recreation operations including energy conservation, cost reductions, safety, maintenance, and design for small structures; Design, a publication on plans for recreation structures.

system, the components of which include the user (the recreationist or the visitor to the park), the environment (the park), the map, and the designer of the map (the recreational agency including the cartographer). One cannot study the map without considering the mapper and user. One must know what the objectives of the maps are and what the mapper intended. It is also important to understand the physical, recreational, and social environments of the parks themselves. The use of the map again depends on the degree to which the mapper emphasizes the attractions of the park and definitely upon the clarity with which such information is presented (the graphic designs and, of course, the accuracy). On the user side of the system is the visitor interest, his experience in the use of the map, and his limitations (map knowledge or his expertise in extracting information from a map). The study considers all the components of the map communication system: the mapper objectives are obtained through interviews, background information on the national parks through literature research, and user expertise in map use through a Map Reading Acuity Test developed for the purpose.

Perhaps the most important requirement in any tourist map is its easy readability--the legibility of the map content and the interpretability of its symbols. The thesis mainly concerns itself with the readability of the park maps: how well do the maps convey their coded and symbolised information to a reader? Is a reader able to derive answers to some common questions he might have regarding a park? The thesis also aims to elicit opinions of the reader on some qualitative attributes (the appearance, information content, etc.) of the maps.

To judge the readability of the maps, a task-oriented approach was used

where an individual, in the laboratory and under standardized illumination, answered a questionnaire developed for the evaluation. The tasks basically involved locating, verifying, and interpreting map symbols. In order to determine the map reading ability of those surveyed, a map reading test preceded the evaluation questionnaire; this was later related to the performances on the park maps to determine if previous map knowledge had an effect on their readability. The individuals surveyed were University of Montana students at both graduate and undergraduate level who represented a variety of disciplines.¹¹

¹¹Chapter 4 of the thesis deals more completely with the objectives, survey design, and methodology used in the study.

Chapter 2

THE NATIONAL PARKS

Extensive recreational travel, based principally on the automobile, is a representative feature of life in the United States.¹² Automobile riding for sightseeing and relaxation and driving for pleasure are among the top activities of Americans participating in outdoor recreation. Though most vacation trips are over short distances, a large number of people travel great distances to parts of the country that afford exceptional opportunities for outdoor recreation and sightseeing.¹³

The term recreation commonly implies activities entered into voluntarily during leisure time, the motivation force being enjoyment and satisfaction as opposed to material gain.¹⁴ This encompasses a wide range of activities forming a continuum from resource-oriented activities on the one hand to activity-oriented pursuits on the other. Resource-oriented recreation or outdoor recreation includes those that occur in an outdoor environment--activities that utilize the natural

¹²Zierer, "Tourism and Recreation," p. 462.

¹³Outdoor Recreation Resources Review Commission, Outdoor Recreation for America: A Report to the President and to the Congress by the Outdoor Recreation Resources Review Commission (Washington D.C.: Government Printing Office, 1962), Appendix F, Table 14, p. 217

¹⁴Clayne R. Jensen, Outdoor Recreation in America: Trends, Problems and Opportunities (Minneapolis: Burgess Publishing Company, 1970), pp. 8-10.

resources such as camping, hiking, sailing, and mountain climbing. Activity-oriented recreation includes participation in, or witnessing of the performance of such activities as athletics, arts, music, and crafts.

The involvement of the federal government in recreation dates back to 1864 when an act of Congress granted Yosemite Valley and the Mariposa Big Tree Grove to the state of California for recreational purposes. The national park concept began as early as 1872 with the establishment of Yellowstone National Park, a tract of about 3,000 square miles which came to be known for some years as The National Park. The history of the discovery of the Yellowstone region began with the Washburn–Langford–Doane Expedition two years earlier in 1870. Rumours and mythical stories regarding its existence, however, had been around since 1807; fantastic tales of geysers and boiling holes had been told by trappers or traders who had unsuspectingly entered the area. The Langford expedition was a privately organized party of nine men sent to satisfy the curiosity concerning the character of the Yellowstone Basin. On the night of September 19, 1870, while the party was laying plans for personal claims to the land, Hedges, a member of the expedition, suggested that rather than capitalizing on their discoveries, the party should seek to have the area set aside for the use and enjoyment of all the people. The idea was immediately accepted by the other members of the group. Debates, however, raged over the fortunes of the area for a year and a half. Finally, on March 1, 1872 the National Park Act received the signature of President Grant; the park was set aside as a public park for the people.

From the 1890's on, Congress set up a succession of national parks, military

parks, battlefields, and memorials. In 1916 the National Park Service, a bureau of the Department of the Interior was created by congressional action for the purpose of establishing and managing a National Park System. The purpose of the National Park Service was:

To conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.¹⁵

As stated above, Yellowstone Park was established in 1872, and before 1916, when the National Park Service was founded, there were actually several national parks in existence. By 1928, the National Park Service had grown to administer 21 national parks and 33 national monuments with a count of 2.6 million visitors annually. Visitor use of areas administered by the National Park Service has increased rapidly over the years. In 1920 little more than one million people visited the areas of the National Park System; in 1930 there were 3.2 million visitors, and by 1950 there was a ten-fold increase to 33.2 million visitors. In 1980 over 300 million people visited the areas administered by the National Park Service.¹⁶ Long-run trends in visitations have been correlated to changes in population and income.¹⁷ Changes in tastes and preferences, the perception of the quality of park

¹⁵William C. Everhart, The National Park Service, with a Foreword by George B. Hartzog, Jr. (New York: Praeger Publishers, 1972), p. 21.

¹⁶Jensen, Outdoor Recreation, pp. 63-65.; U.S., National Park Service, Statistical Abstracts, 1980, Table 2, p. 13.

¹⁷U.S., Department of the Interior, National Park Service, Public Use of the National Park System: Calender Year Report, 1974, pp. 13-35.

experiences, the costs of travel, the characteristics of access to the region, and the climate also determine the uses and levels of use of the parks.

There is a great diversity of types of areas in the National Park System with various titles. In 1983 the National Park Service was administering 20 different kinds of areas ranging from national parks and national recreation areas through national seashores and rivers to national battlefield sites, national historical parks, and national trails.

National parks are defined as:

Spacious land areas essentially of primitive or wilderness character which contain scenery and natural wonders so outstanding in quality that their preservation intact has been provided for by their having been designated and set aside by the Federal Government to be preserved unimpaired for the benefit, enjoyment, and inspiration of the people.¹⁸

National parks are established only by a specific act of Congress.

Freeman Tilden in trying to convey the ultimate meaning of the national parks explains first what they are not.¹⁹ According to him the national parks are not merely places of spectacular scenic features and curiosities or mere places of physical recreation; they are not merely attractions whereby travel facilities are stimulated; and, finally, they are not in the least degree the special property of those who happen to live near them--they are national domain. The major intention of the parks is their preservation and use; national parks are "national

¹⁸U.S., Department of the Interior, National Park Service, Parks for America: A Survey of Park and Related Resources in the Fifty States, and a Preliminary Plan (Washington, D.C.: Government Printing Office, 1964), p. 479.

¹⁹Freeman Tilden, The National Parks, with a Foreward by George B. Hartzog, Jr., 2nd rev. ed. (N.Y.. Alfred A. Knopf, 1970), pp. 19-27.

museums which should embrace the moral, spiritual, and educational welfare of the people and add to the joy of our living.”²⁰

A nationwide study of outdoor recreation preferences conducted by Leslie M. Reid included four national parks (Glacier, Mount Rainier, Rocky Mountain, and Shenandoah) which were grouped under ‘sightseeing’ in a classification of areas by major activity attraction.²¹ This was based on an analysis of activities reported by users in each area and observations made by the teams that visited the areas. Since national parks boast high quality scenic features, sightseeing is a dominant activity. Facilities are designed mainly for this major purpose--roads and parkways are provided with scenic turnouts and observation points; lodging and camping facilities are also made available to visitors. Little or no emphasis is placed on group and supervised sports activities. The majority of visits to the parks studied by Reid were vacation trips, where the users had travelled more than 200 miles from their homes. Sightseeing with stops, walking to scenic spots, photography, and relaxing were listed as major activities in all the four national parks.

Whatever the purpose of their visit, millions of people flock to the national parks each year. The National Park Service (as of Dec.31, 1983) was administering 48 national parks in the country, which together reported the greatest number of

²⁰Ibid., p. 23.

²¹Leslie M. Reid, Outdoor Recreation Preferences: A Nationwide Study of User Desires (Thesis, University of Michigan, n.p., reprint by the B.J. Press, Nov. 1964), p. 64.

recreation visits among the different classified areas under the system.²² Of a total of 243 million visits to the different areas, more than 50 million visits were to the national parks (Fig. 1).

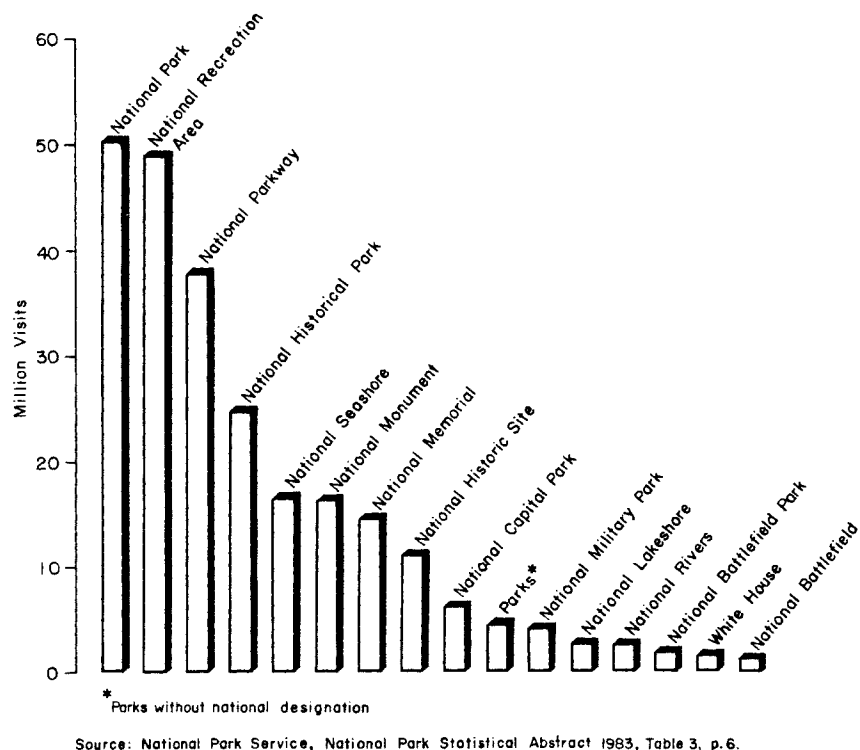


Fig.1 Recreation visits to areas under the National Park System, 1983

Visitor experiences are influenced by the interpretive services and facilities they find in the parks. Environmental interpretation has today evolved into a discipline, and the educational and interpretive programmes in the national parks

²²A recreation visit is defined as entries of persons onto lands or waters administered by the National Park Service for recreation purposes. Visits by service personnel and others as a necessary part of travel incidental to their employment or residence are not reportable as recreational visits : National Park Statistical Abstract.

are "the cornerstone of good park management".²³ An interpreter uses original objects, his firsthand experience, and *illustrative media* to tell a visitor about the park. A map gives a comprehensive image of the park and can act as a tool linking the visitor and the resources (natural or cultural) together.

Area and Parks of Study

The National Park Service, through its Washington office and 10 regional offices administers 48 national parks in the country. An evaluation of all the maps of all the parks was out of the scope of this study. It was decided that a sample area would be chosen and a selective number of parks and their maps considered for evaluation. The Rocky Mountain Region under the administration of the National Park Service formed a convenient unit for the study area. The region includes the states of Montana, North Dakota, South Dakota, Wyoming, Utah, Colorado and a part of Arizona.

The nearness of the national parks of the region to the center of study was an important criterion in the choice of the region. Physiographically, the region comprises parts of the Rocky Mountains and the Colorado Plateau and extends eastward to the edges of the prairies. The Rocky Mountains with its snow mantled peaks, alpine valleys, and high mountain lakes contains some of the most spectacular scenery and primitive wildernesses in the country. The Colorado Plateau offers choice examples of the remnants of great denuding processes--

²³Gary Everhardt, Former Director, National Park Service, Foreward to Interpreting the Environment, by Grant W. Sharpe (John Wiley & Sons, 1982), p. ix.

arches, needles, mesas and buttes, tumultuous rivers, and steep canyons. The flanks of the prairies offer wind-and-water carved canyons, gullies, pyramids, and knobs. The parks thus offer adequate variety in terms of landscape and environment, and contain the oldest and some of the older and newer parks of the system. The area also has a long and interesting history of Indian and Mormon settlement. Zierer, in discussing tourism and recreation, notes that the Western United States contains an exceptionally large amount of land particularly suitable for outdoor recreational use.²⁴ The climate with its low humidity and moisture in the form of snow is an asset. Animals and vegetation are also marked attractions for the tourists.

Falling under the administrative realm of the region are the following national parks (Fig. 2):

1. Arches National Park, Utah
2. Badlands National Park, South Dakota
3. Bryce Canyon National Park, Utah
4. Canyonlands National Park, Utah
5. Capitol Reef National Park, Utah
6. Glacier National Park, Montana
7. Grand Teton National Park, Wyoming
8. Mesa Verde National Park, Colorado
9. Rocky Mountain National Park, Colorado
10. Theodore Roosevelt National Park, North Dakota
11. Wind Cave National Park, South Dakota
12. Yellowstone National Park, Wyoming-Montana
13. Zion National Park, Utah

Yellowstone National Park was established in 1872 and was the first of its kind in the world. Geological features which include 3,000 geysers and hot springs, the Grand Canyon, the falls of the Yellowstone, and Yellowstone Lake at 7,733 feet

²⁴Zierer, "Tourism and Recreation," p. 462-81.

make it a unique place to visit. It is also a wildlife sanctuary and scientific research is conducted with the park. Among the many uses of the park are sightseeing, camping, horseback riding, crosscountry skiing, and snowshoeing.

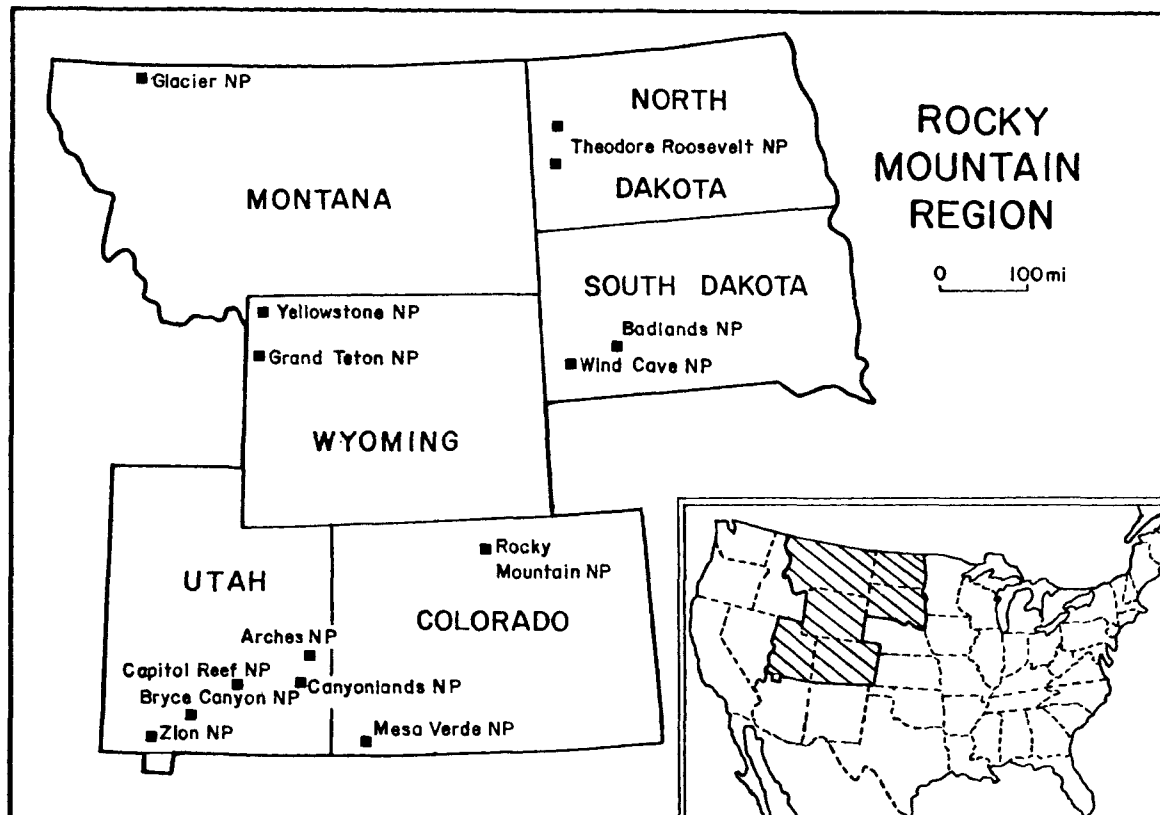


Fig.2 Location of national parks of the study area.

South of Yellowstone lies the majestic Grand Teton National Park. The jagged peaks, cirques, horns, steep slopes, and pinnacles were all carved by ice. The Grand Teton Peak rises 13,766 feet and attracts alpinists from all over the world. Mountaineering is a major activity in the park.

In the Colorado Rockies, straddling the Continental Divide in the Front Range,

is the Rocky Mountain National Park. The Colorado Rockies were once described as "this citadel of Earth; this outpost of heaven".²⁵ About three million people visit the park annually.

Also in the Rocky Mountains, known as the "Alps of America,"²⁶ located in northwestern Montana, is Glacier National Park adjoining the Waterton Lakes National Park in Canada. The significant values of the park have been called "aesthetic, inspirational, and scientific".²⁷

The Colorado Plateau includes three major parks of the study area: Canyonlands, Zion, and Bryce Canyon national parks. As a geographical unit it embraces the Mesa Verde National Park in southwestern Colorado. The major attraction of the three parks is the geology, expressions of which are found in canyons, arches, needles and standing rocks, rapids, and waterfalls. Bryce Canyon (not actually a canyon) is an amphitheater carved by erosion in 50- to 60-million-year-old rocks of the Pink Cliffs. Zion has a long history; it was settled by prehistoric people and Paiute Indians. Horseback and foot trails allow a visitor to explore the backcountry in these parks.

Arches and Capitol Reef national parks located in southeastern Utah also capitalize on their geology. Arches National Park in Utah's red rock country contains more than 200 categorized arches, the greatest concentration of arches

²⁵Samuel Bowles, "the founder and publisher of the Springfield (Massachusetts) Republican known as a severe metallic person and a great economist of prose", quoted in Tilden, National Parks, p. 274.

²⁶Reid, Outdoor Recreation Preferences, p. 35.

²⁷Ibid.

anywhere in the world. Capitol Reef was settled by the Mormons who operated several small uranium mines. Today its monoliths, arches and mazes of canyons carved out of a shale-and-sandstone desert make it a cause for preservation.

Mesa Verde National Park located in the high plateau country of southwestern Colorado is the only area with a park status that was set aside for preservation primarily because of its historical importance. The Anasazi people settled the area for about 700 years from around 550 A.D. The ruins and archaeological remains are the major attractions of the park. The park roads are scenic drives and there are many interpretive programmes. In addition, hiking is a major activity.

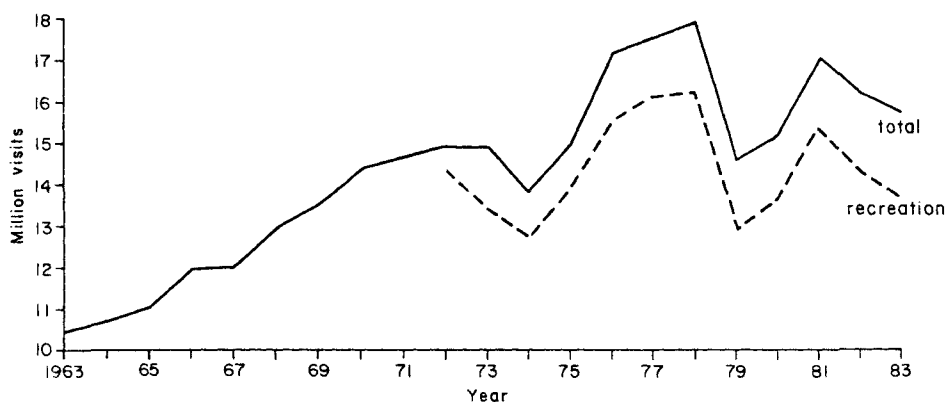
Of a very different nature, contrary to the lofty peaks of the Rocky Mountains or the varied canyons of the Colorado Plateau, on the southeast flanks of the Black Hills of South Dakota, is the Wind Cave National Park. The cave has some 37 miles of lighted passageways containing deposits of fragile crystals. The park is not merely the cave but contains 11,300 hectares of rolling grasslands and pine forests which are a sanctuary for wildlife.

Also in South Dakota is the land which the Dakota Indians called makosica (badland). The area was occupied by the Arikara Indians and later by the Sioux. It is a deeply eroded surface but supports a population of about 300 bison, golden eagles, prairie dogs, rabbits, and snakes. Sightseeing and hiking are major activities in Badlands National Park.

In the badlands of North Dakota is the Theodore Roosevelt National Park. The badlands have a long geological history, the former plain has been sculptured

today into an infinite variety of buttes, tablelands, valleys and gorges. Some 400,000 people visited the park in 1983.²⁸

Of the 50 million people who visited the national parks in the country in 1983, 27 percent visited the parks within the Rocky Mountain Region.²⁹ The annual visitations to the parks in the study area show fluctuations (Fig. 3). Recreational visits increased from 13 million in the early 1960's to more than 16 million in the late 1970's. User studies showed that economic factors (gasoline prices being a major cause) were the major reasons for the fluctuations or downtrends in the number of visits to the parks in 1974.³⁰



Source: National Park Service, Public Use of the National Parks: A Statistical Report, December 1964, 1966, 1968, 1970, 1972; Public Use of the National Park System: Calendar Year Report, 1974, 1975; Statistical Abstracts, 1977, 1980, 1983.

Fig.3 Annual visits to national parks of the study area, 1963-1983.

²⁸This section on the description of the parks is derived from the park folders and Tilden's book on national parks. There are many publications giving descriptions of the various Parks in the country. A fair summary of the parks' attractions are available in the park folders which may be obtained from the superintendents or the Natural History Associations of the individual parks.

²⁹U.S., National Park Service, Statistical Abstract, 1983. Percentage derived from Table 4, pp. 8-29.

³⁰U.S., National Park Service, Calendar Year Report, 1974, pp. 13-35.

The number of visits to the national parks in the country has increased since the war. Several causes have been attributed to this surge in demand for outdoor recreation.³¹ Widespread moves from rural to urban areas, improved highways, more dependable automobiles, higher family incomes, and increased leisure time encourages the interest in outdoor recreation. The Outdoor Recreation Resources Review Commission (O.R.R.R.C.), in its study of outdoor recreation in the United States made future predictions of recreation demand.³² The Commission estimated that that the population would double between 1960 and the year 2000, and the demand for recreation would triple. The standard scheduled workweek, averaging 39 hours in 1960, would drop to 32 hours by A.D. 2000; at least one-fifth of this increased leisure time would be devoted to recreation. One may expect that the demand for interpretive aids such as maps will at least continue on the same level or even increase with this increased participation in outdoor activities.

³¹ Reid, Outdoor Recreation Preferences, p. 1-2.

³² O.R.R.R.C., Outdoor Recreation for America, pp. 30-31.

Chapter 3

THE NATIONAL PARK MAPS

The Recreation Map

In the classification of maps by Robinson and Sale, tourist maps perhaps fit best under the heading 'general maps' in terms of their communication objective where the idea is to represent a variety of geographical phenomena in their correct positional relationship.³³ Yet the recreation map differs from the topographic map in the sense that it has a specialized function and specific subject matter, very similar in this respect to charts and road maps.

Ratajski identified several groups of map users and map functions. Under his scheme, the tourist map is a field-recording or 'source' map.³⁴ The users of maps of this type are 'field-activitists'; the purpose of the maps is always to identify directly perceived field objects. Such maps include road maps, air or nautical charts, large scale geological maps, and hydrological maps. These maps are expected to be very accurate in their recording of the existing objects. According to Ratajski:

³³Arthur Robinson, Randall Sale, and Joel Morrison, Elements of Cartography (N.Y.: John Wiley & Sons, 1978), pp. 7-14.

³⁴Lech Ratajski, "Commission V of the I.C.A.: The Tasks it Faces." International Yearbook of Cartography 14 (1974), p. 141.

. . . they are very detailed maps and the user imposes a number of demands on them, specifically:

- (1) They must be easy and quick to read in various conditions, which implies a good knowledge of human perception, of the adequacy of cartographic signs, the proper choice of colour and some standardization procedures. (On the part of the cartographer)
- (2) The map content must be intelligible, which implies the need to investigate the clarity of exposition of the legend, terminological consistence, the map language syntax and the scope and course of cartographic generalization.
- (3) The map must be easy to handle in various field conditions; this imposes the need to assess the technical features of the map, especially its format, the material on which it is made, its folding and such like.
- (4) The map content must be up to date; this necessitates studies on how to follow the ageing of the elements of the map content and in the ways to update maps.³⁵

³⁵Ibid. Ratajski uses several technical terms which need explanation:

- (a) Cartographic signs: Symbols or marks that a cartographer uses to represent spatial phenomena or data on a map. These must have graphic character which includes location, shape, size, colour, value, pattern and direction. (Robinson, Sale, and Morrison, Elements of Cartography, pp. 80-81.)
- (b) Map language syntax: The relations of the isolated elements or symbols within the total structure of the map. Map elements have no independent meaning (unlike words in a normal language syntax) and have specific meaning because they are involved in an integral presentation. [Arthur H. Robinson and Barbara B. Petchenik, The Nature of Maps: Essays towards Understanding Maps and Mapping (Chicago: University of Chicago Press, 1976), pp. 50-51.]
- (c) Cartographic generalization: The various modifications that are necessarily carried out when reductions are made to map earth phenomena. The operations in generalizations include simplification, classification, symbolization and induction. (Robinson, Sale, and Morrison, Elements of Cartography, pp. 149-150.)
- (d) Format: Size and shape of page or paper on which the map is placed. (Robinson, Sale, and Morrison, Elements of Cartography, p. 286.)

The above best summarizes the technical requirements in a recreation map. Parsons, in his study of recreation maps, identified their several common characteristics. Recreation maps are either navigational or interpretive, or a combination of the two. An important characteristic of a recreation map is its ability to influence the experience of the user through varying the information content or by making a selective presentation of data in the map. By restricting information of sites and routes on maps, one can limit the choice given to the user for choosing alternative routes. The map thus can be a tool for focusing attention on a certain feature in a park; or, it may present detailed and all available information allowing the user to make his own decisions on where he wants to go or what he wants to see or do.

The potential of the map to influence the experience of the user by giving him definitive information can be somewhat surmised by the success of the experiment conducted at Rocky Mountain National Park by two University of Northern Colorado scientists.³⁶ Signs were placed at the head of two similar trails, encouraging the use of the lesser used trail and discouraging the use of the more heavily used trail. The study concluded that it was possible to influence hiker traffic patterns by careful use of informational signs. Hiker response to this control strategy was also favourable. Maps, by presenting such information, may effectively help in park management strategies.

³⁶Richard K. Ormrod and Richard G. Trahan, "Can Signs Help Visitors Control Their Own Behavior?" Trends 19:4 (1982) pp. 25-27.

The function of the map

The map in a recreational framework functions well as a tool, especially in its navigational and interpretive capacity. Where the recreational resource is the environment itself and where the user requires an understanding of the spatial environment, the recreation map has a great potential in bringing the user and the environment together. Recreational maps may also be used as an advertising agent, encouraging the public to engage in a certain recreational activity.

The role of the recreation map may be studied under Clawson's model of the recreation experience. The model defines five stages: (a) an anticipation phase, (b) travel to the site, (c) the on-site activity, (d) return travel, and (e) a recollection phase.³⁷ The anticipation stage is the period of motivation or the period of decision-making. Recreation studies have been interested in describing the type and quality of information available to recreationists at this stage and in the methods by which such information is translated.³⁸ The map obviously has a great potential for providing information of this kind, especially in forming a cognitive image of the area to be visited. Locational information provided by a map is also of importance. Maps for the 'anticipation phase' may be acquired from the different agencies and travel clubs and purchased at bookstores; recreation maps, however, are seldom made for the exclusive purpose of planning trips.

³⁷ Marion Clawson, Land and Water for Recreation: Opportunities, Problems and Policies, Resources for the Future Policy Background Series (Chicago: Rand McNally & Company, 1963), pp. 40-43.

³⁸ David Mercer, "The Role of Perception in the Recreation Experience: A Review and Discussion," Journal of Leisure Research 3 (Fall 1971):263.

There are still few generalizations regarding the travel (travel to, travel back) phases in recreation studies, and there is much research yet to be done on the components of these phases.³⁹ It is often difficult to differentiate between the travel phase and the on-site activity; the road sometimes becoming the site itself. Most travel is, however, navigational; and the map, by providing navigational information may be an important accessory to the activity. Travel may also be an information-gathering activity, especially when the environment travelled in becomes the focus of attention. The map in this case may serve as an interpretive tool.

The on-site phase in recreation is when the recreationist is actually participating in the activity and (in a resource-oriented activity) when the participant interacts with the environment. The fulfillment derived from this activity will depend to a certain extent on the depth of his knowledge of the environment and on the choices available to him to derive whatever satisfaction he desires. The map, by communicating information about the environment, is capable of filling in this lack of knowledge and may make the participant's experience more enjoyable.

Recollection is an important phase in recreation when assessment of an experience takes place. Evaluation depends on what has preceded this stage of recreation and may influence future decisions to a great extent. The map (the material map) in this stage may serve as a reference in recollecting the points and places visited; or, as in most cases, serve as a souvenir of the experience.

³⁹Ibid., p. 267.

Information content

There is a wide variety of recreational activities, each requiring its own type of information. The information content in a recreation map is largely determined by the map author and user studies are rare or have seldom been taken into account. Kolačný, in summarizing this lack of studies regarding a map as a communication link between mapper and user, stated: "There prevails a tacit assumption that the user will simply learn to work with any map which the cartographer makes. In other words, the map user is expected to submit, more or less, to the cartographer's conditions."⁴⁰ The last two decades, however, have seen numerous studies concerning the map as a mapper-user system, and especially concerning the design and effectiveness of the map elements.⁴¹ But studies regarding user requirements for information on particular types of maps, or population background and characteristics studies have been rare.⁴² It is important for the cartographer to know what a recreationist may want to see on a map when visiting a national park. A visitor may be merely driving through the park and be satisfied with knowing where the major roads are, or he may be an avid hiker requiring detailed backcountry information. The designer of the map, by knowing

⁴⁰A. Kolačný, Cartographic Information – A Fundamental Notion and Term in Modern Cartography [Prague: Czechoslovak Committee on Cartography (in English), 1968], p. 1 cited in Robinson and Petchenik, Look of Maps, p. 24.

⁴¹Robinson and Petchenik, Look of Maps, p. 24.

⁴²The methodological approach developed in Canada for the mapping of their national parks included a survey of potential users and their needs for map information related to their activities in the park. Gerald McGrath, "The Mapping of National Parks: A Methodological Approach," Cartographica, Monograph 2 (1971):71-76.

what the general population requires, may aim to satisfy a majority of them.

Depending on the purposes for which it was intended, the information content of a recreation map may vary from a simple presentation of points and places along routes or paths (a numbered tour guide) to the presentation of continuous surface information. Points and places are generally symbolized information, interpretive in nature. They often form the focus of a map, drawing the reader's attention to particular recreation attractions. Information about points and places may be aids in navigation, e.g. orientation of a visitor to a town may be facilitated by characteristic objects such as churches or schools, in a national park by visitor centers or campgrounds. Natural features (such as geysers, peaks, and lakes which form tourist attractions), cultural objects (museums, theatres, and archeological ruins), service facilities (such as shopping markets, gas stations, and motels), and sports and recreation centers (swimming pools, beaches, and ski bowls) may be represented as points or places with names or other descriptive labels.

Joining these points and places of interest are roads, railways, and trails--all essential for navigation. Streets and thoroughfares together with corresponding place names, facilitate orientation in the environment. The recreation map may direct a reader to a particular route or path or it may allow him to choose among alternatives. Most maps show a combination of routes and paths, points and places.

A detailed recreation map may show continuous surface information between places and paths; this may concern physical (through contours, terrain shading,

etc.) or cultural information. This type of information is generally interpretive and may help the recreationist form a mental image of the area traversed.

Important accessories to a map in a recreation environment are the directional signs marking trails, scenic drives, turnouts, etc. These in many cases act as a form of a map, which is especially useful in aiding navigation.

Communication of information

The mapper, the map, and the user together form a system of communication which is similar to many other types of communication networks. It consists of a source (transmitter), a channel which conveys the message, and a receiver. Board asserted that maps were vehicles for the flow of information and employed a generalized communication system (Fig. 4).⁴³ The world and the

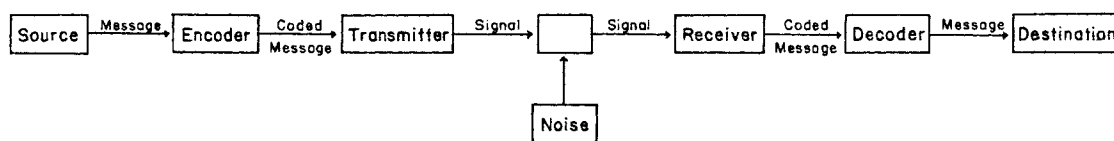


Fig.4 A generalized communication system (after C. Board).

cartographer are the source, the map is the coded message, the signal is the stimulation from the graphic patterns, the channel is space, and the receiver and the decoder are the eyes and mind of the reader or user who is the destination. There are, however, complexities; and, in reality, the map message is seldom

⁴³C. Board, "Maps as Models," in Models in Geography, ed. R. Chorley and P. Haggett (London: Methuen, 1967), pp. 672-675.

decoded the same way in which it was encoded.⁴⁴

The recreation map forms the vehicle for the flow of information from the recreational agency to the recreationist. The use of descriptive text, labels, and photographs with the map is a common practice, the map and the text often coming in the form of a brochure or folder. The text in the folder often has a strong persuasive pitch selling or advertising an activity or area and urging the reader to participate in the activity or visit the area.

The National Park Maps

Maps available to visitors to the national parks vary from simple mimeographed versions to very elaborate multicolour productions. The maps most commonly available to the park visitor--those which appear in National Park Service publications, especially in their park folders--are the product of the Harpers Ferry Center in Harpers Ferry, West Virginia. The cartographic operations are a part of the Division of Publications (U.S. Department of the Interior). Also producing maps and information brochures for the parks is the Natural History Association, a nonprofit, educational, organization authorized by the National Park Service and the Department of the Interior to complement the educational programmes of the National Park Service. Also available in the parks are the topographic maps of the United States Geological Survey.

A map and a general information handout is generally given out free at the entrance station to the park; the more specialized user-oriented maps (trail maps,

⁴⁴Robinson and Petchenik, Look of Maps, pp. 23-42.

geological maps etc.) being available upon enquiry, or for a price at the visitor centers, or from the Natural History Association. This thesis concerns itself only with the 'free' maps produced by the National Park Service because these maps should contain the kind of information that should be available to all the visitors. Moreover, it is likely that a price, however nominal, will screen out at least a portion of the visitors.⁴⁵

The demand for park pamphlets and brochures is ever-increasing. As early as the 1920's, the annual report of the director of the National Park Service mentioned that the demand for pamphlets in the parks was such that only those visitors who requested a copy were supplied with one.⁴⁶ The Harpers Ferry Center produces approximately two million park folders on an average every year, usually with some kind of map in them; some parks distribute in the vicinity of 200,000 folders each season. The average cost of the larger multicolour productions varies between 14-16 cents per copy.⁴⁷

⁴⁵The maps studied in the thesis were available free to the visitors in 1983-1984. Budgetary restrictions, however, have caused most parks to resort to cheaper mimeographed versions or park newsletters for free distribution at the entrance station to a park. The park folders are available for a nominal price (15 to 25 cents) at visitor centers.

⁴⁶U.S., National Park Service. Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal Year Ended June 30, 1921 and the Travel Season, 1921. (Washington, D.C.: Government Printing Office, 1921), p. 42. The publications mentioned in the report are rules and regulations pamphlets and there is no reference to a 'map' in them. References in literature to park maps is scanty to say the least. The most commonly used map seems to have been the topographic maps that were given by the U.S.G.S. to the park superintendents for sale.

⁴⁷Telephone interview with Mr. William Von Allmen, Senior Cartographer, Division of Publications, National Parks Service, Harpers Ferry, West Virginia. May 17, 1985.

Role and function

The park maps, as most recreation maps, may serve their function in the anticipation, on-site, and recollection phases of recreation.⁴⁸ Anticipation is based mainly on expectation. The map, by forming a favourable image of the park in the visitor's mind and by informing him of the available opportunities, may excite his curiosity and make him want to visit the park. The map, by providing information on what there is to see and do in the park, may allow a prospective visitor to plan his stay in the park. Maps for the planning stage may be obtained from the individual parks by request. The national parks do not have a special map for such planning purposes; the park folder commonly available to a visitor in the park is sent along with other written information.

The park map has the greatest potential for use in the on-site phase of recreation. It is generally given to visitors at the entrance station or may be purchased at the visitor center of a park and is used within the park for navigation and for locating recreational opportunities and various service facilities. It mostly serves as a souvenir of the experience in the recollection phase. The following quote from Grant W. Sharpe summarizes the role of the national park map adequately:

Park administrators at every level share a common objective: to improve the quality of experience that visitors may enjoy in their area. The visitor experiences are importantly shaped by the interpretive services and facilities they find there. . . . Managers and interpreters alike know that the prime concern of most visitors is orientation to their

⁴⁸See pp. 23-24.

unfamiliar surroundings. Visitors need to know the location of picnicking or camping sites, food service and other facilities, what there is to see and do – how best to spend their time. Brochures also contain rules and regulations, pertaining specifically to the area, . . .

A good summary of the park interpretive story also belongs in the descriptive brochure, but it should be in a capsule form, just enough to tease the visitor into wanting to learn more. Finally, if the area is large or the least bit confusing, a map is indispensable. Surveys conducted by the National Park Service have shown that visitors want a map above all else, and Park Service folders now devote up to half their space to area maps and inset maps of developed sites.⁴⁹

Telephone interviews conducted with officials⁵⁰ of the 13 national parks of the study area confirmed the above attitudes of the park interpreters. The telephone interviews were conducted April 10 through April 17, 1985 and the interview was partially structured. One major question put to all of the interviewees was: "What is the purpose intended to be served by the map of your park?" (The map in question was specified.)

Nine of the thirteen interviewed officials cited orientation as the major purpose served by the maps. Conveying information about the rules and regulations in the parks and information regarding trails, roads, and facilities (campgrounds and picnic areas, restaurants etc.) was also a major objective. The maps also served to acquaint the visitor with the general layout of the park. Mr. Von Allmen, Senior Cartographer at Harpers Ferry, felt that the map was for very general visitor usage, for taking the visitor through the park in "the most direct manner" and the maps were kept simple so as not to confuse the reader. He felt

⁴⁹Grant W. Sharpe, Interpreting the Environment (John Wiley and Sons, 1982), pp. 285-286.

⁵⁰Appendix A lists the officials interviewed along with a copy of the interview questionnaire.

that the most commonly sought information in the map was the information regarding facilities. Visitors, according to him, are interested in finding places to eat, camp, and sleep above all else.⁵¹

The answer to the question, "do you think the current map achieves this purpose?", was an unanimous "yes" (some very positive, some hesitant, but all nevertheless a "yes"). There had never been any feedback studies regarding the effectiveness of the maps in any of the parks, but complaints regarding the maps were rare or seldom occurred ("Have there been any complaints regarding the inadequacy of the maps?"). Reported cases of lost visitors were rare in all the parks. Where there had been occurrences of lost visitors (Badlands and Arches national parks), this was mainly attributed to the inadequacy of road signs within the parks.

Information content and graphic conception

The information content in park maps may be considered in terms of their objectives. Since one function of a national park map is to provide 'on-site' information, it should contain information that facilitates orientation to the park--highways and major roads along with their names. Other outstanding features such as campgrounds, visitor centers, and scenic viewpoints should also be represented on the map. It is necessary that this be reinforced by adequate road signs.

A park folder is used by visitors to plan how best to spend their time in the park. They are often interested in a more general information: how large the Park

⁵¹Telephone interview with Mr. William Von Allmen, May 17, 1985.

is, what the major attractions are, what service facilities are available. This type of information is usually incorporated into the written text in the folder and the map provides a good supplement to show locations. Rules and regulations (information regarding hiking permits, safety measures, use of roads, trails, and campgrounds) are also usually found in the form of written text.

Since national parks are defined as "spacious land areas essentially of primitive or wilderness character which contain scenery and natural wonders,"⁵² the mapping of landforms and other physical features becomes important. It is the physical environment itself that becomes the object of attraction in a park; visitors would almost always want to know where the glaciers, lakes, or waterfalls are located. Sightseeing is the major activity in most parks; hiking, camping, riding, fishing, etc. are also popular. A visitor also needs to know if gas or food is available in the park. Recreational and service facilities are of fundamental importance to visitors and these must be represented as completely as possible. There are, therefore, two definite types of information in park maps: (a) physiographic information--mountains, canyons, rivers, lakes, waterfalls, geysers and hotsprings, and (b) cultural information--roads, hiking and interpretive trails, campgrounds, gas stations, visitor centers, etc. The quantity and type of information that is incorporated in park maps is determined by the individual national park administrators to suit the particular needs of their parks. The actual map is designed and produced at Harpers Ferry, West Virginia, where the

⁵²National Park Service, Parks for America, p. 479.

cartographic services are located.

An examination of the maps sent by the 13 national parks of the study region⁵³ shows a considerable diversity in their appearances or 'looks'. They vary from slick multicoloured folders (59x42 cms) through smaller four- or two-coloured folders (varying sizes) to monochrome single sheet maps (43x35 cms). The scales of the maps also vary depending on the size of the park and the area it occupies in the folder space. The size of the map, of course, must determine to a certain extent the amount of information that is in the maps.

The National Park Service uses a variety of specially designed symbols both as map symbols and as road signs in the parklands for general information,



Fig.5 Symbols used by the National Park Service to represent recreational and other facilities in their parks.

⁵³The maps considered for the study were requested by mail from the individual national parks.

recreation facilities and opportunities, and information on accommodations and services (Fig. 5). The symbols were born out of a National Park Service sign study and are a result of careful designing and research. According to Vincent Gleason, Chief, Division of Publications, National Park Service,

Symbols in the NPS system have the advantage of being more explicit than words, so that more can be communicated in a short space and sign sizes can be reduced. These symbols are generally understood by people around the world, and therefore are useful to non-English speaking visitors.⁵⁴

The representation of relief or land features in the studied park maps varies from just naming features without any cartographic portrayal, through representing elevations as spot heights, to the use of elaborate terrain shading.

Classification

The level of information presented in the maps of the national parks under study is varied and diverse. There cannot, of course, be a single map type for the national parks of the country; each map has to meet the special needs of, and conditions found in each park. There are, however, distinct similarities in map types. These 'like' individuals in the park maps studied, readily lent themselves to classification into definite groups or categories. The classification chosen for the study was the agglomeration method as opposed to the logical subdivisional approach.⁵⁵ The subdivisional method entails dividing a population into groups and

⁵⁴Vincent Gleason, "Signs for Parklands", Trends (Jan/Feb/March, 1975), pp. 14-16.

⁵⁵Ronald Abler, John S. Adams, and Peter Gould, Spatial Organization: The Geographer's View of the World (Englewood Cliffs, N.J.: Prentice Hall, Inc., 1971), pp. 150-55.

subgroups based on some defined criteria; the agglomeration takes the individuals of a population and groups them into categories on the basis of their similarities. The maps considered for the study have some similar characteristics, and are agglomerated into categories based on these similarities. Though the agglomeration method minimizes variation among individuals belonging in one group, it is important to note, however, that there *are* variations. 'A' is more similar to 'B' than it to 'C' is the basic principle underlying the grouping of the maps.

This organization into categories allowed inductive generalizations to be made of each class type. The maps of the parks are diverse, both in terms of the amount of information they carry and their designs. It was impractical to analyze all of the maps of all of the parks. The classification allowed one representative map to be chosen out of each type for evaluation; the results could then be applied to the group as a whole. This grouping into 'like' individuals also had a definite operational advantage making it faster and easier to weigh one 'type' of map against the other.

The maps considered for the study were requested by mail from the individual national parks. The parks were asked to send 'all cartographic products available to a visitor'; some maps were also purchased for inspection. Only the 'free' maps were considered for the evaluation.⁵⁶ Each park has its park folder, some parks (the larger and older parks viz. Glacier, Grand Teton, Yellowstone and Rocky Mountain national parks) also use a monochrome or two-colour single sheet

⁵⁶See page 29.

map. A total of 16 maps were, therefore, considered for the study and were grouped into three major categories: (1) the simple park folders, (2) tear off sheets, and (3) the complex park folders. The grouping was based on three major characteristics--degree and detail of information, its graphic representation, and the look or general appearance of the folders.

The information content in the parks maps is of two types: physical and cultural. These may be grouped, as in most recreation maps, as points or places, routes and paths, or continuous surfaces of information. This information content varies from a simple presentation of the major roads and highways with some point and place information (visitor centers, campgrounds, and names of major points of interest) to continuous surface information--relief representation of the mapped area and details of backcountry hiking trails. Hence 'what' information and 'how much' information were important variables on which the groups are determined.

The quantity of information, though extremely important in recreation mapping, does not by itself determine what a 'good' map or a 'bad' map is. Equally important are the graphic elements and how such information has been coded--the information needs to be easily understood by those who are unfamiliar with the area. Included in the variables considered for grouping the maps were, therefore, the ways in which the information was depicted. Since the National Park Service uses standardized symbols to represent recreational and service facilities, the differentiation into groups was mainly based on the representation of topography which varies among the different maps. The complex park folders all

have relief represented by terrain shading, the tear off sheets generally use spot heights to show elevation, and the simple park folders show little or no relief.

The graphic design in totality contributes to the overall appearance of the map. The look of the map is important--the cognitive image formed in a tourist's mind is likely to be more favourable if the overall design and appearance of a map is sufficiently attractive. The division of the maps on their 'appearance' was based on Petchenik's approach of verbalizing the look of maps.⁵⁷ To evaluate specific impressions of maps, five general characteristics may be used: spatial characteristics, texture, light, data quality impressions, and emotional reactions.⁵⁸ The classification considered the spatial characteristics of the maps, in a polar-word pairing 'open-crowded'. The terms have no technical cartographic meaning and are literal translations of the words. The maps were judged on their relative appearances--the smaller scale used for the tear off sheets, for example, make the maps seem 'crowded' as opposed to its multicolour counterpart.

Table 3-1 summarizes the classification scheme. The maps belonging to the first category (the simple park folders) mainly emphasize points and places along the major roads through the parks. Physical information is minimal, there is no cartographic representation of relief (for example contours, or drawings of mountains, etc.). This lack of detailed information gives the map an open look. Folders of Arches, Badlands, Capitol Reef, Theodore Roosevelt and Wind Cave

⁵⁷Barbara B. Petchenik, "A Verbal Approach to Characterizing the Look of Maps," The American Cartographer 1 (1974):63-71.

⁵⁸Ibid., p. 69.

national parks fall within this category. The Arches and Wind Cave maps use multicolour, resembling the maps of third category in this respect, but do not show continuous surface information; the other maps mainly rely on shades of a single colour. All the folders contain written text, diagrams, or photographs (either in colour or in black and white).

The maps belonging to the second category are single sheet, unfolded maps (tear off sheets) and contain little or no written text. There is no descriptive information or photographs, the text mainly comprises rules and regulations. These, in fact, are single- or two-colour versions of the maps in the complex park folders. The information content in the maps is essentially the same as in its colour counterpart; the monochrome and duochrome versions do not allow for relief representation by elaborate terrain shading, nor do they allow colour differentiation of the different road types etc. Since most parks currently charge a price for their colour folders, and since most parks are resorting to cheaper monochrome versions of maps for free distribution; the evaluation of this map type becomes important. A comparative study is made between the maps the different groups, especially of the maps of the second and third categories.

The maps belonging to the third category (complex park folders) are mainly multicolour park folders which include descriptive text and colour photographs. The folders are much larger than the ones belonging to the other categories, allowing greater detail of information. Relief of the mapped area is represented as terrain shading which provides the continuous surface information and which allows for a more balanced look to the map. Maps of Bryce Canyon, Canyonlands, Grand Teton,

Table 3-1: Classification of the National Park Maps

	Folders/Maps of National Parks (ed.)	Physical Information	Depiction of Physical Information	Cultural Information	Appearance and Additional Information
I. SIMPLE PARK FOLDERS	Arches NP (1983) Badlands NP (1983) Capitol Reef NP (1983) Theodore Roosevelt NP (1983) Wind Cave NP (1983)	Landform (relief) not shown. Drainage represented.	Ridges and valleys NAMED in some. Drainage varies from single lines of black to categorised blue lines.	Emphasis mainly on points and places along major routes. Facilities shown.	'Open' spatial characteristic. Shades of one colour or multicolour. Additional information includes descriptive text of the park and photographs in colour or in black and white. Folder.
II. TEAR OFF SHEETS	Glacier NP (1983) Grand Teton/Yellowstone NP (1983) Rocky Mountain NP (1984)	Landform shown. Lakes and drainage represented.	Elevation shown as spot heights. Peaks, rivers, lakes, named. Height given in both meter and mile.	Sites along routes and some inter-area information. Facilities shown.	'Crowded' spatial characteris- tic. Monochrome or duochrome. Little or no written text. Where present, mainly rules and regulations. Tear off sheet.
III. COMPLEX PARK FOLDERS	Bryce Canyon NP (1983) Canyonlands NP (1983) Glacier NP (1981) Grand Teton NP (1984) Mesa Verde NP (1984) Rocky Mountain NP (1984) Yellowstone NP (1983) Zion NP (1984)	Landform shown. Lakes and drainage represented.	Landform shown by terrain shading. Peaks, rivers, lakes, named. Height given in both meter and mile.	Sites along routes and continuous surface infor- mation. Facilities shown.	'Open' to 'balanced' spatial characteristic. Multicolour. Additional information includes descriptive text of the park and photographs in colour. Folder.

Glacier, Mesa Verde, Rocky Mountain, Yellowstone and Zion national parks fall within this category.

The selection of a representative map from each group for the purposes of evaluation, the research design, and methodology are discussed in the next chapter.

Chapter 4

RESEARCH DESIGN AND METHODOLOGY

The thesis objectives and the methodology used to evaluate the national park maps were outlined briefly in Chapter 1. A detailed discussion follows below.

The Objectives

A primary goal of the thesis is to evaluate the national park map--to see how well the map communicates information especially in regard to the purposes for which it was intended. Is a user able to get answers to some of the more common questions he might have regarding a park? Can he locate the various facilities he may require? Is the map reader able to comprehend the layout of the park? Can he tell how far one point of interest is from another or how steep the road is? Does the map entice him to visit the park?

Finding answers to the above questions probably closely relates to the 'readability' of the park map; a map after all is "simply various kinds of marks arranged on a sheet of paper or some other medium."⁵⁹ How readable are these various marks and symbols and how well do they communicate the information the National Park Service intended them to convey? How intelligible is the map content?

⁵⁹Arthur H. Robinson, "The Uniqueness of the Map," The American Cartographer 5 (1970):5.

The graphic design of maps (how the symbols are arranged, modulated, and fitted together) definitely determines how readable the coded information is; it also influences the reader's impression of the map and the cognitive images formed. As stated earlier, individual park maps differ not only in what information is present or how much of it, but also in how such information has been coded.⁶⁰ The information content of the maps common to the two classification types: the tear off sheets and the complex park folders are identical, only their graphic designs are different. Is there a significant difference in the readability of these map types?

In judging a map for its readability, one must of course take into consideration the *ability* of the map reader to extract information from maps and his experience in map use. It is to be expected that the more skilled the user in his map reading abilities the better he will be at interpreting the park map. The park maps are directed, however, at a varied population, a certain percentage of which may have little skill or previous experiences in map reading. Is there a correlation between an individual's map reading acuity in general and his ability to read park maps in specific? Can 'anybody' read a park map?

Supplementary questions in the thesis attempt to elicit user opinions on some qualitative attributes of the maps and the degree to which users actually need information from park maps.

⁶⁰See page 40.

The Survey Design

The thesis evaluates national park maps by having a sample population answer a questionnaire designed for the purpose. It was considered impractical to evaluate all of the maps of all the national parks of the study area. A classification scheme was developed in Chapter 3⁶¹ which would allow the selection of a single representative map from each group for evaluation purposes. Accordingly, there were two samples: one was taken from among the park maps; the other was taken from among students attending the University of Montana. The method of selection of each is discussed below.

The maps selected

The 16 maps considered in the study were classified into three categories based on the information content and design of the maps. This allowed a single map to be chosen from each 'type' for evaluation. Based on the results of the evaluation of these three maps, generalizations could then be made for each type of park map: simple park folder, tear off sheet or the complex park folder. The following criteria were applied in making the selections:

(1) Each of the three maps selected should best represent their respective groups. This meant selection of a map from the middle of the array of the slight variations that occur within each class type;

(2) The parks which the maps represent should be the ones least apt to have

⁶¹See Table 3-1, page 40.

been visited by the sample population. The evaluation of the park map would not then be biased by a population with previous knowledge of the park or actual use of the park map.

The first criterion was especially important in the selection of the map representing the first group. The map of the Badlands National Park seems to fall in the middle of an array ranging from the very simple map of Theodore Roosevelt National Park to a somewhat more complex map of Arches National Park or the Capitol Reef National Park. The map of the Wind Cave National Park was not considered for the survey as the tour of the cave is a guided one.

The second criterion was more important in selecting maps from the second and third classification types. Glacier and Yellowstone are perhaps two of the most visited parks in the region. It was expected that a majority of the readers would have visited these parks, in which case their experience (knowledge of the park) would bias the judgement of the map. Rocky Mountain National Park, in terms of the physical distance from Missoula, was perhaps the least visited and hence the best choice. The comparative objective of the study determined that the maps from the third and second types be the same.

The thesis therefore evaluates three national park maps: those of the Badlands National Park (Edition: GPO:1983-381-578/234 Reprint 1981) and the Rocky Mountain National Park (GPO:1984-421-578/470; GPO:1984-421-578/449 Reprint 1984). For the purposes of the study, the maps of the three classification types are referred to as BNP (Badlands National Park), RMB (Rocky Mountain Black) and RMC (Rocky Mountain Colour). (See maps in attached back pocket.)

The survey sample

The study is based on questionnaires distributed to a sample number of university students. The immediate question that arises to mind is: are the university students representative of the general populace that visits national parks? Are they not the educated, 'knowledgeable' group who would create a bias in judging the map? Ideally, perhaps the sample should be a more varied one and include the nonstudent population. University students are, however, an important part of the population that visits national parks, their participation is perhaps the most active in terms of demands for maps (hiking and getting off the beaten automobile track). Their state of knowledge about maps may be determined by a test and a comparison made between this test and the performance in the park map test, thus offsetting the bias created.

The survey sample consisted of University of Montana students enrolled during Spring Quarter, 1985 and the First Session of Summer, 1985. The students enrolling in the summer sessions included teachers and other professionals, 'outsiders' who likely made the population more representative of the tourist population.

The student participation in the study was voluntary. The survey was approved by the University of Montana Institutional Review Board for Use of Human Subjects in Research.

The survey design and methodology

There are three units of analysis: BNP, RMB, and RMC. It is necessary that an unbiased judgement be made of each map and comparative judgement of the last two. A single group of students (users) could evaluate the different versions of the park maps, but this would certainly create a bias since the later evaluation would be influenced by the map seen previously. Again, if the users looking at each map are different, one cannot be sure that their abilities are equal, and to ensure equality of reading groups one would have to allocate large numbers of people at random to each group. However, one can ensure similarity between groups by *deliberately* assigning people of known map reading capabilities to those different groups. One may argue of loss of randomness in the sampling process; it is important to realise, however, that the unit of analysis is the park map and the student population merely an accessory in evaluating it.⁶²

The survey therefore had several distinct stages which may be briefly outlined as follows (Fig. 6):

(1) A Map Reading Acuity Test first determined the ability of the survey sample to read maps;

(2) The sample was then divided into three groups: BNPG (Badlands National Park Group), RMBG (Rocky Mountain Black Group), and RMCG (Rocky Mountain Colour Group) of similar reading capabilities based on their map reading scores;

(3) The three groups formed were then asked to evaluate the three park

⁶²This does not in any way mean that the population is not important to the study, but that the study is not a survey of the student body itself.

maps BNP, RMB, and RMC respectively; one group was assigned to each map.

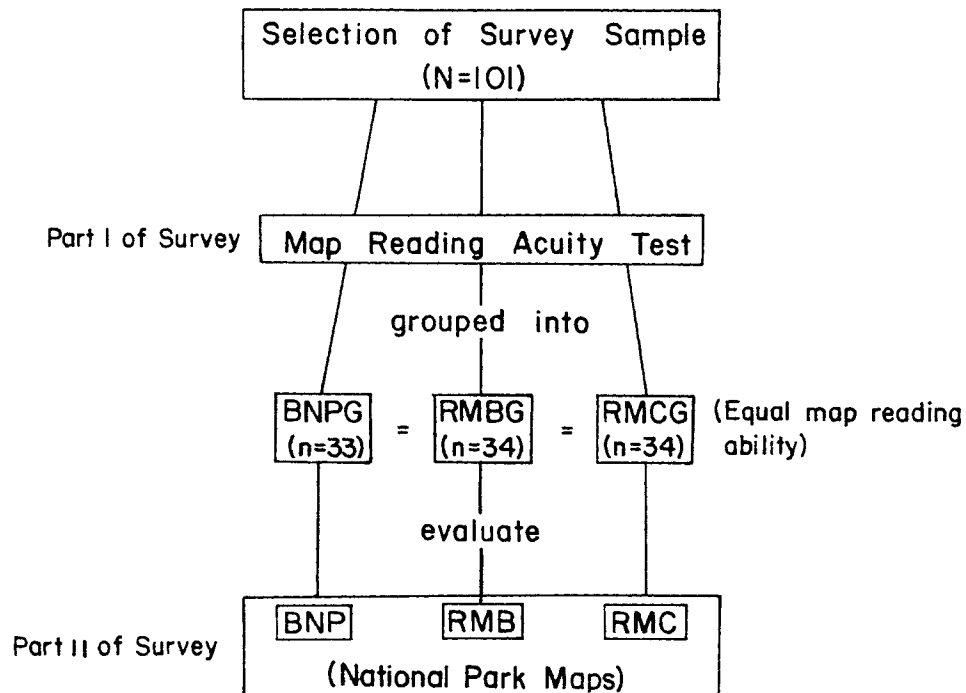


Fig.6 The survey design.

Questionnaire Design

All of the questionnaires are reproduced in appendix A. The reader may refer to these as their various components are discussed in the text which follows. The questionnaires were designed to satisfy three separate goals:

- (1) to determine the background of an individual especially in regard to his map reading/map use experiences (first page of questionnaire),
- (2) to test the map reading acuity of the individual (Part I of the survey questionnaire) and
- (3) to evaluate the park map (Part II of the survey questionnaire).

Background information sought included the students' class standing and

major field of study. It also sought data concerning previous course work or instruction in map reading, and the frequency of usage of the different types of maps (topographic, road, city, recreation, etc.).

The Map Reading Acuity Test (Part I) required careful designing. There are no standardized map reading tests in cartography which may be applied to determine an individual's state of knowledge of maps. It seems to be customary or quite acceptable, however, to use topographic maps for such a purpose. The map reading test was initially based upon a similar test given by Smith when conducting a test involving topographic and orthophotomaps.⁶³ The initial questionnaire, used in a pilot test, had four sections; the first concerned general questions regarding maps, the second involved interpreting symbols, the third determining direction and distance, and the fourth required information to be read from a given topographic map. The map used for the purposes of the Map Reading Acuity Test was the U.S.G.S. Furnace Creek Quadrangle Map, 15 minute series (topographic), 1:62,560, 1952.⁶⁴

The questions relating to the park maps (Part II) were designed keeping the purposes of the maps in mind. The readability questions mainly concerned location, direction, and distance; the location of points and places, tracing routes and paths, measuring distances along roads, and interpreting the map symbols. These

⁶³Carlos A. Smith, "A Test Concerning the Relative Readability of Topographic and Orthophotomaps," The American Cartographer 4 (1977):133-143.

⁶⁴This particular map is not included with the questionnaire. Topographic maps may be obtained from the U.S. Geological Survey, Denver, Colorado 80225.

constitute the numbered questions and are graded for a score. Since the thesis evaluates three park maps, there are three distinct questionnaires for this Part II of the survey, the readability questions in each relating to the specific park and map. The RMB and RMC maps contain the same information content; the former is a duochrome version of the latter. The two maps are judged for their comparative readability. The questionnaires for the two maps are for the most part identical.⁶⁵ Questions also concerned the reader's opinion of the map regarding its appearance, information content, and general usability. These questions are common to all three map types.

The Pretest: A Brief Summary, Conclusions and Modifications

When conducting a questionnaire survey, it is often customary to 'pretest' the questionnaires themselves, especially to identify their weaknesses and omissions, or one may test the survey design itself by going through the whole survey-analysis process in a sort of 'minisurvey'. A pretest was conducted May 17-18, 1985 primarily to test the effectiveness of the questionnaires designed for the survey. Fifteen voluntary respondents were involved: five individuals completed the questionnaires for each of the three maps. The two tests (the Map Reading Acuity Test and the Park Map Evaluation) were conducted in succession. When the pretest was conducted, the decision had not yet been made to divide the students into three groups with similar map reading abilities. It was felt at that time that a

⁶⁵The RMC contains one additional question on colour (Q.21) and one supplementary question to Q.14. The scores attained on these questions are not used when comparing the relative readability of the two maps RMB and RMC.

large enough sampling population would be available which would ensure three groups of similar reading capabilities. The participants were asked to work at their own pace but as efficiently as possible and the survey was timed for each individual.

One of the primary difficulties encountered while conducting the pretest was finding a sufficient number of voluntary participants to take the tests. This nonavailability of participants would be a major factor in determining the sample size for the main survey.

The statistical tests performed on pretest data showed that the purpose of the sampling design and indeed the study objective itself was defeated. The F test of variance performed on Map Reading Acuity scores of the three groups showed that there was a significant *difference* in the reading capabilities of these; this meant that a comparison could not be made between the performances on the RMB and RMC maps. The small sample size was no doubt a factor in the result.⁶⁶ Considering the difficulty of finding a large enough population to ensure groups with equal reading capabilities, and the average time taken to complete both the tests in succession (an hour and a half), it was decided that the survey would be conducted in two distinct parts. The Map Reading Acuity Test would be conducted first, based on the results of which the population would be divided into three groups of equal reading abilities, the population would then be recalled to do the park map evaluation. The time period between the first and second parts was not

⁶⁶The results were confirmed by the Krustal-Wallis Test.

deemed sufficient for a participant to increase his map reading capabilities to any great extent. The majority of the Part II surveys were conducted within a 48-hour period.

As stated earlier, the participation in the survey was voluntary and the sampling random to that extent. Some randomness of choice also remained in the assigning of individuals to read the three map types. One of the important considerations was whether the individual had visited the park. If the individual had not visited either of the parks, he was assigned to a particular map group randomly. If he had visited the Badlands National Park, he was assigned to one of the other two groups (RMB or RMC) randomly. In some cases, however, the assignment of an individual to a certain map group was deliberate to maintain equal readability skills between the groups.

The pretest showed weaknesses and redundancies in the initial questionnaires. An important consideration was time--the Map Reading Acuity Test was reduced from four to three sections and emphasis was placed on extracting information from the given map. Several questions were rephrased and the revised form of the questionnaire was tested again on three participants before the main survey took place.

The Main Survey

The main survey was conducted from May 23 through June 8 and again from June 15 through June 30, 1985 in the Geography Research Laboratory under fluorescent light. There were no procedural difficulties encountered. The survey

results are reported and interpreted in the following chapter.

Analytical Procedures

The Map Reading Acuity Test measures an individual's ability to read a map. A point was recorded for each correct answer and half a point for ambiguous or partially correct ones. The maximum score attainable for the test was 23. The answers to the various questions on the Park Map Evaluation are used to judge the map on individual items and also to determine the overall readability of the map . The readability is simply related to the average number of correctly answered questions. The maximum scores for the BNP, RMB, and RMC maps were 17, 27 and 29 respectively. In total there are two scores for each student--a map reading acuity score and a park performance score.

Statistical procedures were used to test for significance between the different groups. The F test was used to confirm that the three reading groups were similar in their reading capabilities. The difference of means test (t) was used to determine if a significant difference exists between the average level of readability of the RMB and RMC maps.

Pearson's correlation coefficient (r) was used to determine if there was a significant relationship between map reading capabilities and actual performance levels on the park maps.

Chapter 5

ANALYSIS AND INTERPRETATION

As outlined in Chapter 4, the study used a task-oriented approach to evaluate the national park maps, where a sample number of university students answered a questionnaire designed for the purposes of evaluation. The evaluation questionnaire was preceded by a Map Reading Acuity Test to determine an individual's ability to read a map. The sample was divided into three groups of similar mean reading capabilities on the basis of the map reading scores. The three groups then evaluated the three national park maps considered in the study. Background information of the sample was also sought, especially in regard to its experiences in map use. This chapter first examines the characteristics of the sample in regard to its class standing, field of study, and experiences in map use; then it discusses the Map Reading Acuity Test; and, finally, reports and analyzes the results of the park map evaluation.

Sample Characteristics

The survey sample consisted of students attending the University of Montana, Spring Quarter and First Session of Summer, 1985. Participation in the survey was voluntary. The background information of the sample sought included student class standing and major field of study; and, as relevant information to map reading, their eyesight, training in map reading, and frequency of map use.

Student class standing

Of the 101 students participating in the study, 12.9% were freshmen, 10.9% sophomores, 19.8% juniors, 28.7% seniors, 25.8% graduates (including graduate nondegree) and 1.9% were earning their second bachelor's degree (Post B). This shows a fairly even distribution of students in the sample in terms of class standing.

Major field of study

A total of 33 disciplines were represented by the survey sample, the most students in any one discipline being 24 from the Education Department and 16 from the Business and Accounting Department. Other disciplines represented were: Art (2), Biological Sciences (1), Botany (1), Communication Sciences and Disorders (1), Computer Science (2), Economics (4), English (3), Environmental Studies (2), Foreign Languages and Literature (2), Forestry (2), Geography (7), Geology (2), Guidance and Counseling (2), History (3), Interpersonal Communications (1), Mathematical Sciences (1), Medical Science (1), Music (1), Nursing (1), Pharmacy (2), Political Science (2), Pre-Medicine (1), Pre-Physical Therapy (2), Psychology (1), R-TV (1), Recreation Management (3), Rural, Town and Regional Planning (2) Social Science (1), Social Work (2), Sociology (1), Wildlife Biology (1), General (3).

Eyesight

Of the total surveyed sample, 52.5% wore prescribed glasses (or contact lenses) while 47.5% did not. Only one student reported partial colour blindness.

Previous training in map reading

One of the disadvantages that may be cited in selecting the university population to represent the tourist population is that a fair number of the students may have had formal instruction in map reading and thus form a 'knowledgable' group which may not be totally representative of the general population. Table 5-1 below shows the number of participants who had had instruction in map reading. Those who had had such training or instruction were requested to list the courses taken or cite other experiences such as that obtained from the military, the scouts, etc. About 58% of the sample had *not* received any formal instruction in map reading--there seems to be a fair balance in the population between students with formal training in map reading and those who had not had such training.

Table 5-1: Percentage of Sample with Instructions in Map Reading

Q: Have you had instructions in map reading? (If yes, list courses and other experiences.)

Answer	Percentage of total (no.)	Have had other experiences (no.)
Yes	42.6 (43)	20
No	57.4 (58)	12

Courses cited included those received in school or university, in the departments of geography, geology or forestry, or in the army or navy. 'Other

experiences' included job experiences with the Forest Service, guides and scouts, backpacking clubs, and 'personal' experiences.

Frequency of map use

How often did the participants use maps in general? Being a university population, one may expect that the use of maps among the sample would be rather common, especially among students majoring in geography and other related disciplines (geology, forestry, etc). Table 5-2 shows the frequency of use of the different types of maps among the surveyed sample:

Table 5-2: Frequency of Map Use among the Sample

Q: How often do you think you use the following maps?

Map Types	Percentage of sample using the map				
	Very Often	Quite Often	Often	Rarely	Not at All
Road maps	13.9	22.8	36.6	26.7	0.0
City maps	5.9	12.9	39.6	40.6	1.0
Topo maps	4.0	14.8	18.8	40.6	21.8
Atlas maps	4.0	9.9	30.7	48.5	6.9
Special maps	2.0	4.0	7.9	47.5	38.6
Recreation maps	2.0	11.8	41.6	40.6	4.0
Book maps	4.0	10.8	30.7	44.6	9.9

The overall distribution shows that there was quite a variation in the frequency of map use among the participants. Road maps were the most frequently used (73% forming the 'often' categories), followed by city maps (58.4%) and the recreation map (55.4%). Special maps (geological, population etc.) were the least used with only 13.9% constituting the 'very often', 'quite often' and 'often'

categories. The frequency of use of the topographic and recreation maps are especially relevant to the study. The Map Reading Acuity Test was based on a U.S.G.S. topographic map, and the thesis evaluates the national park maps which are recreation maps. Topographic maps were used rarely (40.6%) or not at all (21.8%) by 62.4% of the sample, and often (very often, quite often or often) by 37.6% of it. The recreation map also had a fair share of frequent and rare users: 41.6% used the recreation map often and 40.6% rarely. The above results do suggest that the sample did not consist entirely of 'knowledgable', experienced map users and that the map reading test or the evaluation of the park maps was not particularly biased by it.

Park visitation

All of the surveyed sample had visited a national park somewhere in the country. One may conclude therefore, that the sample was familiar with the national park concept and did represent a population that would visit or had, in fact, visited the parks. Since the units of analysis were the maps of the Badlands National Park and the Rocky Mountain National Park, it was necessary to know how many participants had visited the two parks. This was relevant criterion in assigning the population to read a particular map type, especially those participants who had visited the parks in question within the last five years. A knowledge of the park and especially previous use of the park map in question would probably affect the evaluation of the map; the reader's answers may be derived from sources other than the park map or folder in question. A participant who had visited the Badlands National Park in recent years was assigned to

evaluate one of the Rocky Mountain maps and vice versa.

Table 5-3: Visitation to the National Parks

Q: Have you visited the following national parks? When?

Park	Number of sample visiting in the		
	1980's	1970's	before 1970
Badlands N. P.	15	14	2
Rocky Mountain N.P.	6	9	3

It is only logical to assume that a participant's evaluation of the park map is affected by his map knowledge and experiences in map use. The study does not directly correlate the background information (as derived in this section of sample characteristics) with the performances on the park map. It is expected that an individual's map knowledge and experience is well represented by his score in the Map Reading Acuity Test.

The Map Reading Acuity Test

The Map Reading Acuity Test (MRAT) was aimed at determining an individual's ability to read maps. The tasks basically involved finding direction and distance, locating and interpreting map symbols.⁶⁷ Section I of the test concerned some general questions regarding maps; Section II involved symbol recognition, and Section III dealt with reading information off the given Furnace Creek Quadrangle map. The participants were provided with the necessary tools for

⁶⁷See Chapter 4, page 49; for questionnaire see appendix A.

measurements. There was no time limit on the test. The maximum attainable scores for the three sections were 5, 6, and 12 respectively, giving a total maximum attainable score of 23. The test scores and the individual section scores for the 101 sample cases are listed in appendix B. The range of scores and the mean scores for each section are tabulated below:

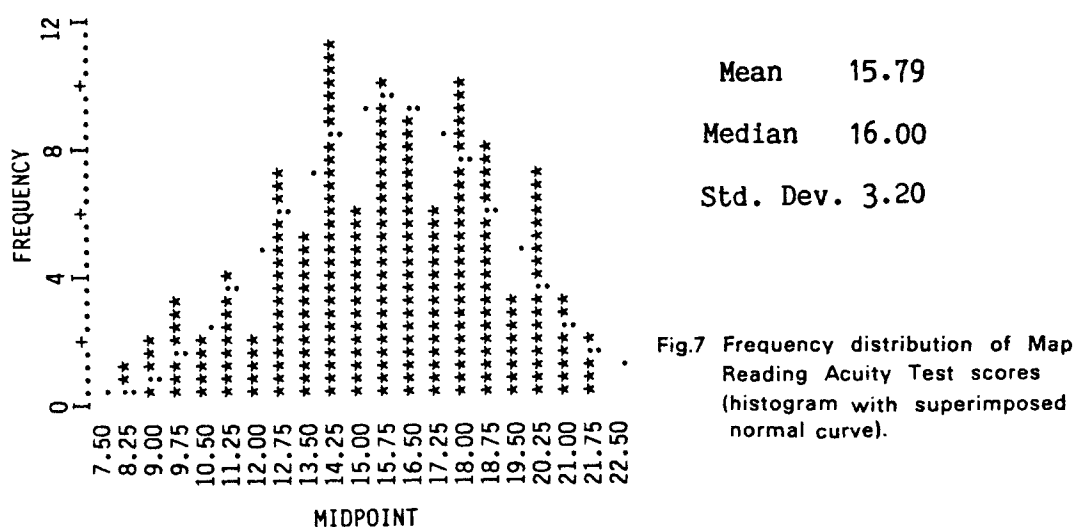
Table 5-4: Sectional and Total Range & Mean Scores (MRAT)

	Sec. I	Sec. II	Sec. III	Total
Maximum score attainable	5	6	12	23
Range (min, max)	3, 5	0, 6	2, 11	8.5, 22
Mean score	4.25	4.35	6.99	15.8

The results show a wide range of map reading capabilities within the population. The performances on Section I and II were quite high. The participants were familiar with the standard colour coding used for U.S.G.S. topographic maps: 96% of the sample matching all the four colours to their corresponding symbols correctly. A majority of the sample was able to interpret the more common symbols, railroad (96%), road (88%), and contours (94%) accurately. Only a quarter of the sample identified the school symbol and around 50% identified the stream and quarry symbols correctly. In reading information off the quadrangle map, the greatest difficulty was encountered in determining the location of places by coordinates (only 18% locating the required feature) and in measuring distances and directions (azimuths). The contours and major land features were interpreted correctly in a majority of cases: 94% identifying the uphill direction of the road and 89% judging the comparative slope of the Panamint and Black Mountain

ranges correctly.

The frequency distribution of the scores (Fig. 7) shows a slight negative skew. The scores range from a minimum of 8.50 to a maximum of 22.0. An equal number of the sample (48) lies below and above the median value (16.00). The 95% confidence interval for the mean indicates that the mean reading score for the population represented by the sample lies between 15.15 and 16.42.⁶⁸



95% Confidence Interval for the Mean = (15.15, 16.42)

The Map Reading Acuity Test is not analyzed in any further detail, on a question by question basis. The test scores are considered a measure of an individual's ability to read maps and used for the purposes of survey design. The test scores are later compared to performances on the park maps to identify a correlation, if any, between an individual's state of knowledge of maps and his ability to read information off a particular type of map.

⁶⁸For frequency distribution of the individual score values and more measures of central tendency and variation see appendix B.

The Map Reading Groups

The methodology used in the thesis required that the sample be divided into three groups of similar map reading capabilities based on the scores of the Map Reading Acuity Test. The three groups would then evaluate the three units of analysis.⁶⁹ A total of 101 voluntary students participated in the survey. They were divided into three groups (one for each map BNP, RMB and RMC) of 33, 34, and 34 students each.

The frequency distributions of the map reading scores in each group is represented in Figure 8. The mean, median, and standard deviation values are given in Table 5-5.⁷⁰

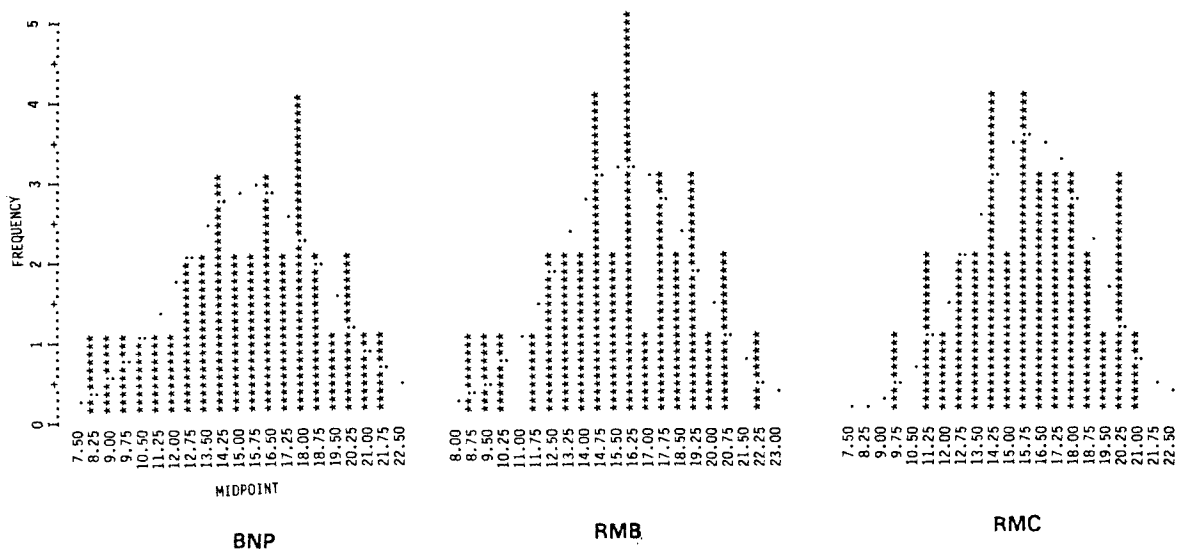


Fig.8 Frequency distribution of Map Reading Acuity Test scores in the three map reading groups.

⁶⁹See Chapter 4, page 47.

⁷⁰The groups, with the individual case numbers and corresponding map reading scores, are listed in appendix B.

Table 5-5: Selected Statistical Measures for the Map Reading Groups

Reading group	Mean	Median	Std. Dev.
BNP	15.576	16.000	3.505
RMB	15.897	16.000	3.256
RMC	15.882	16.000	2.918

A one-way analysis of variance indicates that the three groups had no difference in their mean reading capabilities:

Table 5-6: Analysis of Variance for the Map Reading Groups

Source	D.F.	Sum of Sq.	Mean Sq.	F Ratio	F Prob.
Between groups	2	2.1935	1.0968	0.105	0.9005
Within groups	98	1023.9797	10.4488		
Total	100	1026.1733			

These three predetermined groups evaluated the three national park maps considered in the study. Since the reading capabilities were similar among the groups, any differences in the interpretation of the park maps by the samples could be attributed to the park maps themselves.

Park Map Evaluation

The thesis evaluates three national park maps: BNP (park folder of the Badlands National Park), RMB and RMC (maps of the Rocky Mountain National Park). Each map belongs to a category or map type in the classification scheme developed in Chapter 3. The study mainly concerns the 'readability' of these maps; the questionnaire developed for the purposes of evaluation (see appendix A) also elicits reader opinion of some qualitative attributes (appearance, information content) of the maps.⁷¹ The results of the Park map evaluation (Part II of the survey) is discussed below.

Appearance of the folders and maps

Is it important whether the user finds the map 'attractive' so long as it serves its purpose? The park map is designed as an orientation guide and a locator guide, for the purposes of which a map showing such data (roads, location of facilities, points and places) would have been adequate. Yet the park maps today hardly resemble those in 'minifolders' of the 1960s.⁷² The changes no doubt related to the changes in production technology,⁷³ but hopefully carried with it a further purpose than merely guiding a visitor through a Park.

⁷¹The thesis objectives were discussed in detail in Chapter 4.

⁷²These were also produced by the National Park Service and were in the form of a booklet with a (simple) map generally in the center fold. Descriptive text would often include the geology, flora and fauna, and a history of the park.

⁷³Telephone Interview, William Von Allmen, 17 May 1985.

Indeed the look of the map is important; this is especially so for a tourist map. The following verbal descriptions of some European tourist maps give a feel for the importance of the appearance of a map:

. . . a sense of place so that one can feel the awesome grandeur of . . . , as the Swiss maps do. . . the eye with its artistry so that one wants to frame it for a decoration rather than soil it in use as a touring guide, as the map of the Romantic Route through Germany does. . . one into dallying for extra days of autumn in some forest inn, as does the ARAL map of the Schwarzwald. . . excite the imagination and curiosity about the great persons of history who travelled the same route in ages past as does the Spanish map of the Road to Santiago.⁷⁴

The survey participants were asked to rate their first impressions of the folders and maps; the folders on an 'attraction' scale and the maps on a 'complexity' scale. The results give a general impression of an individual's reaction to the folders and maps as a whole. The evaluation is based on the semantic differential method suggested by Petchenik⁷⁵ and uses polar word pairings "attractive-unattractive" for the folders and "clear-complex" for the maps.⁷⁶ The ratings for the park folders and the maps are illustrated in Figure 9. Table 5-7 shows the mean ratings for the three types of maps.

All the folders rate on the 'attractive' side of the scale. The RMC folder with its descriptive text, colourful photographs, shaded relief, and more distinguishable colours rates the highest on the attraction scale. It is also more 'clear' looking than

⁷⁴Harrington, "Tourist Map of the United States," p. 557

⁷⁵Petchenik, "Verbal Approach," pp. 67-71.

⁷⁶The terms used here have no technical cartographic meaning and are just literary translations of the words, an 'open' look as opposed to a 'crowded' look for example.

its duochrome counterpart, the RMB map; part of the openness may be attributed to the larger scale of the RMC Map.

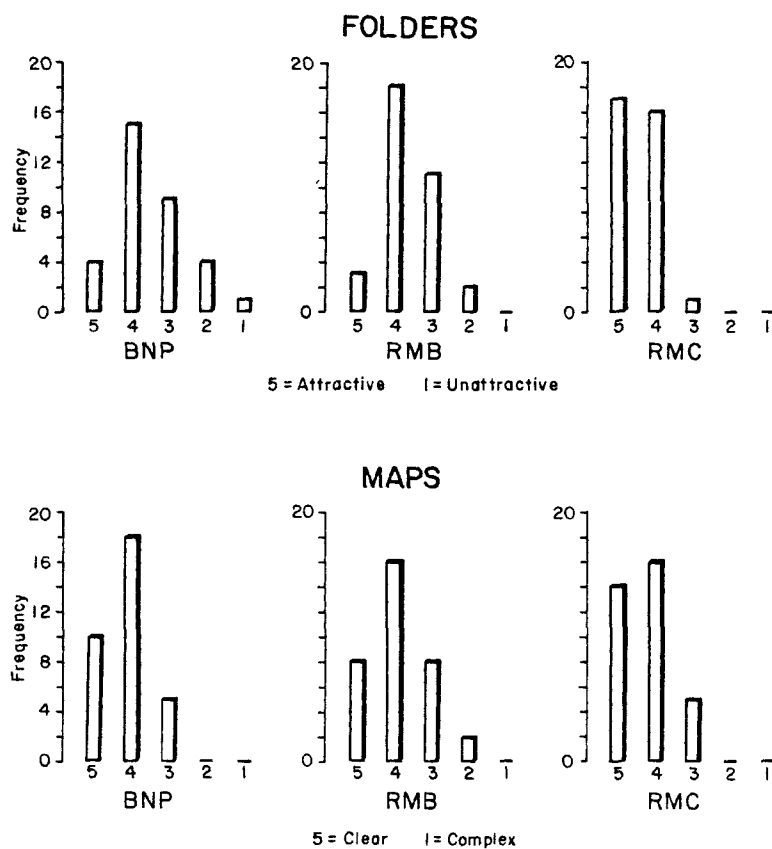


Fig.9 Appearance ratings for folders and maps.

Table 5-7: Mean Ratings for the Appearance of Folders and Maps

Park Map	Folder	Map
BNP	3.52	4.15
RMB	3.65	3.88
RMC	4.47	4.29

One of the purposes of the park map must be to spark visitor interest in the park, to tease the visitor to learn more. Does the park folder make the participant want to visit the park? This question was posed at the end of the readability test and hence the answers were given after the reader had had a chance to scrutinize the map contents. The results (Table 5-8) are significant and follow the same pattern as the attraction ratings.

Table 5-8: Percentage (number) of Sample Wishing to Visit the Parks

Q: The folder makes you want to visit the park

Answer	Park folder		
	BNP	RMB	RMC
Yes	54%(18)	44%(15)	85%(29)
No	40%(13)	50%(17)	15%(5)
No answer	6%(2)	6%(2)	0%(0)

About 85% of the sample group evaluating the colour folder of the Rocky Mountain National Park felt inclined to visit the park. The corresponding figure for the duochrome version (RMB) is only 44%. The BNP, map which is also a colour folder, recorded a higher percentage of people wanting to visit the park. This perhaps speaks for the advantage of having an 'attractive' map or folder to entice a visitor to a park.

The participants were asked how the folder affected their decision to visit the parks. The folder's 'attractiveness' is, of course, relative and based on an individual's personal judgement. The positive responses, however, all seemed to correspond to the cognitive images formed of the parks especially so from the

RMC map. The lofty mountains, the lakes and valleys, and the availability of various recreational opportunities, were enticing; undoubtedly, the photographs and text also contributed to the favourable perception of the park. Discouragement (mostly in the RMB map) seems to have occurred where the reader was unable to justify a visit to the park (by failing to perceive what was unique and attractive about the parks) or, where he was unable to locate the necessary facilities or recreational opportunities. The regulations cited in the RMB map were often considered negative and definitely discouraging. Of the 97 participants recording a positive or negative response, 10 cited strongly personal reasons for wanting to visit the parks ("I like the outdoors"). The following quotes are from the survey:

About BNP:

- "Yes, the description of the park is detailed and makes it sound like an exciting and a beautiful place to visit." "Yes, there is enough information to get you curious and interested."
- "No, the pamphlet is dull, not colorful enough. The area seems out of the way and isolated. There are not very good accommodations available." "No, the map is very puzzling. What are the elevations? Which way is north? Where are the scenic features?"

About RMB:

- "Yes, this park looks like it has a lot to offer." "Yes, it is attractive and seems to stress a programmed itinerary for travelers."
- "No, it doesn't convey the richness that is contained within the the environment that lies within the park." "No, the regulations are very negative--the regulations are not clear about which facilities are open when. No information on scenic beauty etc."

About RMC:

- "Yes, the pamphlet is attractive and paints a picturesque, interesting scene of the park. Much of the text is informative and highlights key points of each topic. It also points 'something for

everyone'." "Yes, by the photos shown, it looks like a beautiful place."

"No, there doesn't seem anything unique about the park." "No, it would be difficult to plan a day . . . difficult to find the peaks and streams because they are all the same print . . . I didn't like the map."

The written text, the descriptions, and the photographs are an integral part of the publication and definitely influence the reader's image of the parks. It is not possible to determine from a laboratory experiment how many people visiting the parks actually 'read' the text in the folders. The participants were asked to evaluate the written text in the folder:

Table 5-9: Sample Opinion of the Written Text in the Folders

Q: This is in reference to the written text in the folder

Answers	Percentage of sample (no.)		
	BNP	RMB	RMC
a) It appears interesting	73%(24)	9%(3)	74%(25)
b) It appears helpful	64%(21)	68%(23)	85%(29)
c) It seems to be of little relevance	9%(3)	24%(8)	6%(2)
d) It is too long	—	—	3%(1)
e) You feel written informa- tion should not be included with a map	3%(1)	6%(2)	—

The text in the BNP and RMC folders are descriptive and illustrate the highlights of the park. These were appreciated by the sample as being interesting and helpful. The text in the RMB sheet consists of a list of rules and regulations for the park. The majority of the sample felt that this was helpful; it is interesting to note that almost a quarter of the sample thought that this information was not

'relevant'. About 15% of the sample admitted to not paying much attention to written information in folders.

The qualitative judgements and impressions discussed above concern the general 'look' of the maps. The look of the map is affected not only by the character of the elements that compose it but also by the technological processes and materials involved in the making of the map.⁷⁷ All the three park maps rate fairly high on the attraction scale. Maps, however, must combine 'beauty' with 'utility' (beauty for a tourist map also serves as a utility). A major part of each questionnaire involved the location, verification, and interpretation of information on the maps. Measuring distances or establishing locations of specific features pertains to each particular park and map. The park maps, however, all use standardized symbols to represent recreational and service facilities.⁷⁸ It was felt that these merited special attention and are evaluated separately first.

Symbol recognition







The National Park Service uses a variety of symbols both as map symbols and as signs in the parklands for general information, recreation facilities and opportunities, and information on accommodations and services (Fig. 5). A total of six symbols were chosen for interpretation by the sample, a number of which (two symbols for BNP and three for RMB and RMC respectively) were represented in the legends of the given maps.

⁷⁷Petchenik, "Verbal Approach," p. 64

⁷⁸See page 34.

Table 5-10: Symbol Recognition (number of correct identifications)

Q: What do the following symbols represent?

	1a	1b	1c	1d	1e	1f
Park Map						
BNP	30*	33*	30	27	32	7
RMB	33*	34*	29	26	30	20*
RMC	33*	34*	32	27	32	29*
Total	(95%)*	(100%)*	(90%)	(79%)	(93%)	(72%)*

*Symbol represented in the legend of the map.

The results show the ability of each symbol to convey its intended message effectively. Symbols 1a and 1b are represented in the legends of all three maps and their level of recognition is very high (Table 5-10). Number 1f is represented in the legends of both Rocky Mountain maps, yet its recognition is strikingly low. A plausible explanation seems to be that the legends in the maps were not paid much attention, especially so in the case of the Rocky Mountain maps--there seems to be no reason why an individual reading symbols 1a and 1b from the legend would not read 1f as well. Symbols 1a and 1b are common symbols--picnic areas and ranger stations are often marked along highways and not only in national parks. The interpretive trail symbol (number 1f) was, moreover, the most misinterpreted being confused as 'cooking facilities', 'barbeque pits' and 'garbage disposal'.

Ideally symbols, especially those used for tourist maps, should have forms that allow them to be read without the help of a map legend. The above results,

although recording high percentages of recognition for most symbols, do suggest that the legend should be made a more prominent part of the map--both in terms of its position in the map space and its being graphically bolder.

The readability of the park maps

Perhaps the most important requirement in a map is its easy readability and legibility of the information content. The park folders are all attractive and pleasing; but do they answer specific questions (location of feature, distances between points of interest, etc.) which a reader may have regarding a park? How readable are the various symbols and marks used in the park maps? Readability in this case is denoted by the ability of the reader to locate, verify, and interpret the symbols and signs of the maps. The numbered questions in the questionnaires (see appendix A) are used to judge the maps for their readability and are graded for a score. Since the written text seems an integral part of the folder, some questions pertained to it.

The answers to the various questions concerning the park map evaluation are used to judge the maps on individual items (symbol recognition, line weights used, or the different elements of graphic design) and also to determine the overall readability of the maps. The readability is simply related to the average number of correctly answered questions. The scores attained on this section of the park map evaluation by the individual participants, along with their performances in the map reading test (MRAT scores), are listed in appendix B.

The BNP map

The BNP map represents the simplest form of the Park maps in terms of the level of information present and its graphic presentation. Table 5-11 gives some statistical measures of the scores attained by the sample group (BNP) on the readability section of the BNP Map. The maximum attainable score in the BNP map was 17. The mean score is 12.36 (range 9 to 16) and only 24% of the scores lie below 12.00 (the median value). The frequency distribution of the scores is represented in Figure 10.

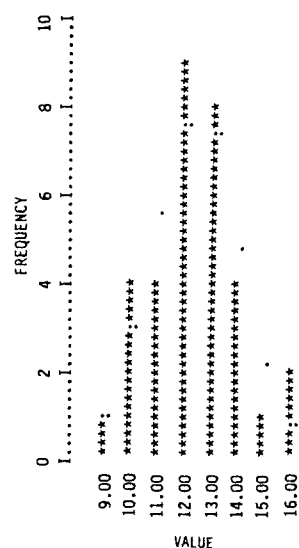


Fig.10 Frequency distribution of readability scores for BNP

Table 5-11: Selected Statistical Measures for the BNP Map

Mean	12.364	Median	12.000	Mode	12.000
Std Dev	1.674	Minimum	9.000	Maximum	16.000

95% Confidence Interval for the Mean = (11.77, 12.95)

The percentage and number of correct answers for each of the (numbered) questions is listed in the BNP questionnaire in appendix A. Of the 17 questions asked, 73% on an average were answered correctly. The individual percentages of correct answers vary from a full 100% to as low as 21%. The highest percentage of correct answers were to questions where the information required was actually verbally spelled out in the map (Q.5, 6 and 8), and the lowest scores resulted from information that had to be derived or inferred from the given information in the map (Q.12, 14). Information that had to be read off the legend were arrayed in the middle.

The students were asked to rate the difficulty or ease with which they read information off the map (Table 5-12). Their response averaged 2.97 which lies almost exactly in the middle of the scale between very difficult and very easy.

Table 5-12: Ease or Difficulty of Extraction of Information from the BNP Map

Q: You found the extraction of information from the map

	Very difficult			Very easy	
	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>
Percentage of sample (no.)	3%(1)	24%(8)	42%(14)	27%(9)	3%(1)

The performances on the park maps were correlated to the map reading scores as derived from the MRAT. The scatter diagram (Fig. 11) shows very little consistency in any kind of pattern. The relation varies from high performances on the park map on the lower end of the acuity scale to poor performances on the higher end of the map acuity scale. The diagram distinguishes cases of recent park

visitation and actual map use. The two cases of high park map performances on the lower end of the acuity scale may be explained by their previous park knowledge (both had visited the park and one had actually used the park folder in question). The three poorer scores on the higher end of the acuity scale have no such obvious explanation. Of the three cases, two used both topographic maps and recreation maps often, the third rarely used either.

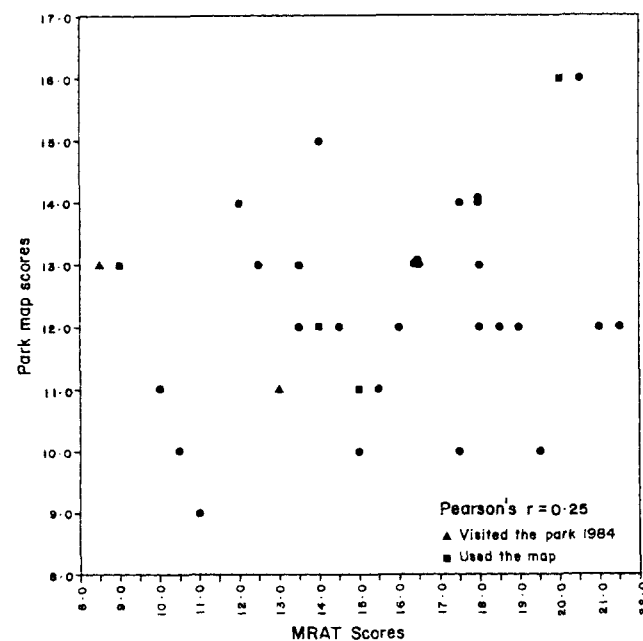


Fig.11 Correlation between map reading acuity and performance on the BNP map.

The association between an individual's ability to read maps and his performance on the park map was tested using Pearson's r . The study hypothesizes that there is a positive correlation between the two variables ($p > 0$). Pearson's r for the data is 0.25. Testing (one-tailed, $p > 0$) for the significance of r at the 0.05 level one finds that $0.25 < 0.292$ (tabular r at $df=31$). The null hypothesis cannot be rejected and the observed association is not significant. The relation

between the sample's map reading capabilities and their ability to interpret the BNP map was not strong.

This lack of association between an individual's former map knowledge and the readability of the BNP map perhaps speaks well for the park map. Apparently, the map can be read with a fair amount of accuracy by a population without any extensive previous map knowledge. But the map is simple, with minimal information about the park: there is no physiographic detail, no relief representation. Distances along roads are cited verbatim, and only a few points and places are named along the major roads. There is very little information to be read off the map. The participants were asked to rate the information content of the map on an adequacy scale (Table 5-13).

Table 5-13: Rating for the Information Content of the BNP Map

Q: Rate the information content of the map on the scale below

	Excessive			Inadequate	
	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>
Percentage of sample (no.)	3%(1)	12%(4)	52%(17)	33%(11)	0%(0)

Though it is difficult to judge the adequacy of information on a map without actually working with it in the field, the results give a theoretical need for the amount of information that people would like to have on a park map. The average rating of 2.85 for the information content lies slightly on the 'inadequate' side of the scale. A majority of the population advocated depiction of relief or topography and that the map show more hiking trails (Table 5-14):

Table 5-14: Desired Changes in the BNP Map

Q: You would like to see the following changes in the map of the park

	Percentage of sample (no.)
a. The map should show relief or topography	39%(13)
b. The map should show relief or topography in more detail	55%(18)
c. The map should show more hiking trails	55%(18)
d. Other:	
"There should be a list of plants as well as animals. .	
Make the roads distinctly different. . . .	
Improve the scale--its hard to see. . . .	
A different color would help. . . .	
Colors relating to topography and vegetation could be more interesting. . . .	
Different color delineation. . . .	
Be a little more colorful. . . .	
Colored pictures of animals would help interest. . . .	
More pictures of the terrain. . . .	
Could be more clear on the services available. . . .	
More information on how to read the map. . . .	
I like to see what area of the state the park is in. .	
Another small map should place this map with respect to South Dakota and the major highways. . . .	
Add a little excitement to the folder."	

The RMB and RMC maps

The two versions of the Rocky Mountain map represent the second and third classification types. The maps have almost identical information content, the RMB map appears to be a duochrome version of the colour map. The RMC map is one of the most representative of national park maps in the country, recent budget restrictions have, however, required most parks to charge a price for them while the mimeographed or monochrome versions are distributed free.

The study makes a comparative evaluation of the readability of the RMB and RMC Maps. The two maps, therefore, are discussed together. If there is a significant difference in the performance levels on the two park maps, the reasons for the differences must be explained. Since the reading capabilities of the two groups evaluating the two maps is predetermined and similar, the performance levels or any differences between may be attributed to the designs of the maps and their graphic representation. The RMC map rated higher on the attractiveness scale (Table 5-7, Fig. 9). One presumes that this map, with the additional visual information, bolder visual contrasts, and larger scale is the more readable of the two. If there is no difference in the effectiveness of the two maps to communicate the required information, could the park service resort to producing only the cheaper monochrome version of the map?

The scores attained by the sampling groups on the numbered questions for the RMB and RMC maps along with the map reading scores are listed in appendix

B.⁷⁹ The frequency distributions of the scores attained on the RMB and RMC maps are represented in Figure 12. Some statistical measures for the RMB and RMC maps are tabulated below (Table 5-15). The mean value for the RMC Map lies above that for the RMB map; the range of scores is wider for the RMB map (13) as compared to the range of scores for the RMC map (9).

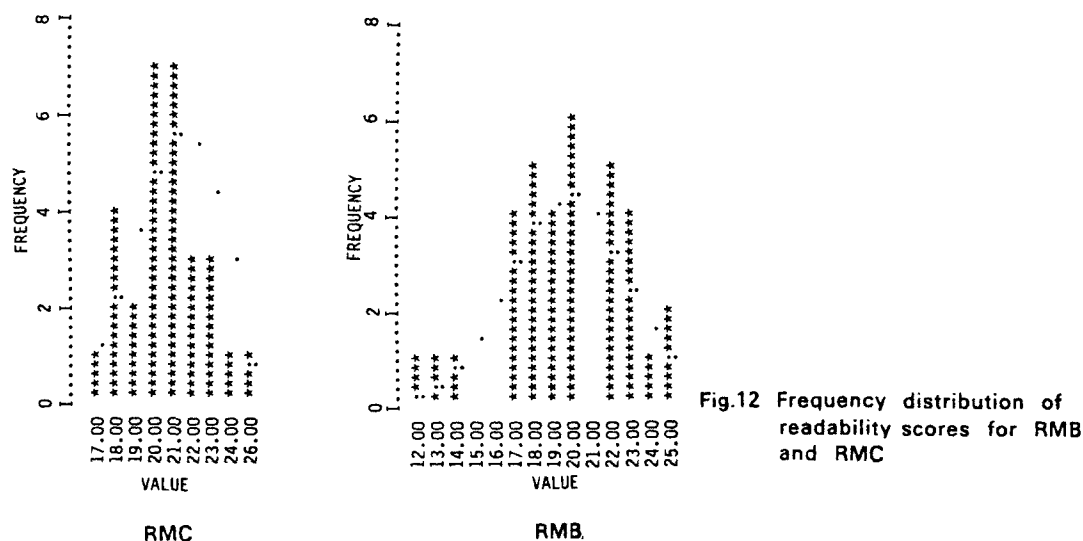


Table 5-15: Selected Statistical Measures for the RMB and RMC Maps

Map	Mean	Median	Mode	Std.Dev	Min.	Max.
RMB	19.68	20.00	20.00	3.15	12.00	25.00
RMC	21.29	21.00	20.00	2.42	17.00	26.00
95% Confidence Interval for the RMB Mean = (18.58, 20.70)						
95% Confidence Interval for the RMC Mean = (20.45, 22.14)						

⁷⁹RMC has an additional question on colour (Q.21). The score attained on this question is not used in any comparative statistics for the two maps. The comparative statistics use scores attained on Q.1-20.

A difference of means test (t) was used to determine whether or not there was a significant difference between the average level of readability of the two maps. This comparability required that the two groups reading the two maps (RMB and RMC) had similar map reading skills.

Table 5-16: T-Test for the RMB and RMC Groups

Variable	No. of cases	Mean	Std.Dev.	T Value	DF	Prob.
RMB	34	15.897	3.356	0.02	66	0.984
RMC	34	15.882	2.918			

The two-tailed test ($t=0.02$, $p=0.98$) indicates there is no significant difference in the map reading abilities of two groups. One can assume therefore that any differences in the performance levels on the two maps, RMB and RMC, are a result of the differences in the maps themselves.

Table 5-17: T-Test for the RMB and RMC Maps

Variable	No. of cases	Mean	Std.Dev.	T Value	DF	Prob.
RMB	34	19.676	3.150	-2.38	66	0.010
RMC	34	21.294	2.419			

The study hypothesizes that the four multicolour park map has a better readability than its duochrome counterpart. The t test (one-tailed, $t=2.38$, $p=0.01$) indicates that this is indeed true. The colour map has a significantly better

readability than the black and white map.⁸⁰ The 95% confidence interval for the difference between the two means is: (0.26, 2.98).

The number of correct identifications for each (numbered) question for the two maps is indicated in the questionnaire in appendix A. The RMC map shows approximately 7% more correct identifications on the average over the RMB map. There were absolute differences in levels of performances for some questions; some symbols were identified correctly in both the maps and some were poorly read despite the improvements in design in the RMC map.

The significant differences in the ability to identify some symbols (Q.4, 5, 6, 9, 10 & 13) may be related to the improved graphic presentation--use of colour, terrain shading, larger scale, and bolder contrasts--on the RMC map. Information stated verbally in the text (Q.2, 18) and familiar symbols (Q.1a & b) are identified correctly on both the maps. Poorly read information (Q.11, 16) indicates the necessity for bolder visual contrast; poor performances are also indicated on information that had to be derived secondarily or inferred from the information present in the maps (Q.8, 17, 20).

As for the BNP map, the subjects were asked to rate the difficulty or ease with which they read information off the RMB and RMC maps. The results (Table 5-18) were different in each case. The responses averaged 3.53 for the RMB map (and lies on the 'difficult' side of the scale) and 2.97 for the RMC map ('easy' side

⁸⁰The F-values for the two tests: $F=1.25$, $p=0.53$ (for Table 5-16) and $F=1.70$, $p=0.13$ (for Table 5-17), suggest homogenous sample variances. The hypothesis was also accepted under the nonparametric Mann-Whitney test.

of the scale.)

Table 5-18: Ease or Difficulty of Extraction of Information from the RMB and RMC Maps

Q: You found the extraction the information from the map

	Very difficult			Very easy	
	5	4	3	2	1
Percentage of sample (no.) RMB	9%(3)	47%(16)	32%(11)	12%(4)	0%(0)
RMC	3%(1)	24%(8)	44%(15)	26%(9)	3%(1)

The performances of the samples on the RMB and RMC maps were correlated to the Map Acuity scores. The scatter diagrams (Figures 13 & 14) show definite patterns. The prevailing tendency for both the RMB and RMC maps seems to be that the individuals with higher acuity scores performed better on the park maps. There are no 'explained' cases as for the BNP map.

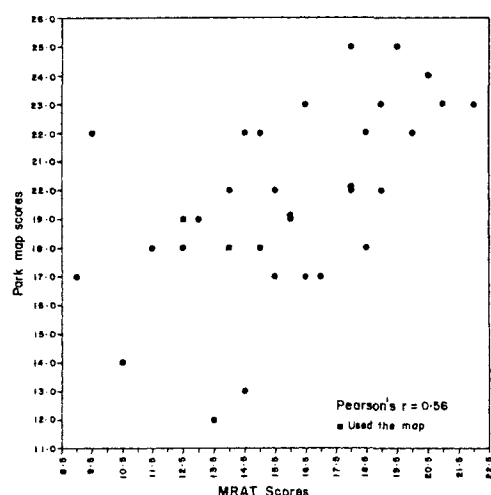


Fig.13 Correlation between map reading acuity and performance on the RMB map.

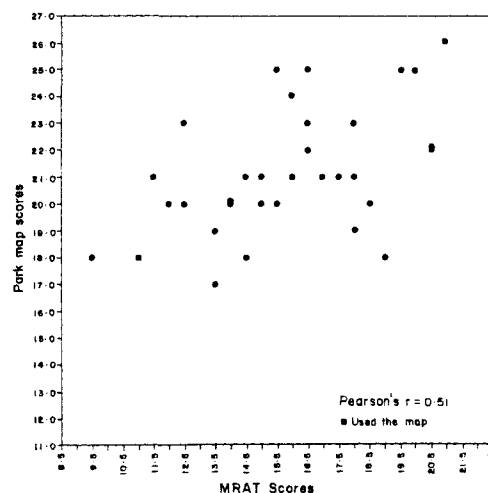


Fig.14 Correlation between map reading acuity and performance on the RMC map.

Pearson's r was used to determine if there was an association between an individual's map reading ability (scores derived from the MRAT) and his ability to extract information from the two park maps. Again, as for the BNP map, one expects that there would be a positive relationship between the two variables. Testing Pearson's r for significance (one-tailed at the 0.05 level) one finds that $r = 0.56 > 0.287 [r_{0.05, 32}]$ for the RMB map and $r = 0.51 > 0.287 [r_{0.05, 32}]$ for the RMC map. The null hypotheses may be rejected and one may conclude that there is a significant and positive relationship between the samples' map reading capabilities and the performances on the two national park maps. Both maps show greater detail than the BNP map and are more complex in this respect. There was no correlation between an individual's map knowledge and his ability to interpret the BNP map; the results for the RMB and RMC maps suggest that it would be advantageous to visitor to have had previous experiences with maps when encountering the more complex national park maps.

The students were asked to rate the information content in the RMB and RMC maps (Table 5-19). Mean ratings of 2.79 and 2.76 for the RMB and RMC maps both lie below the middle of the adequacy scale. The percentages of the sampled population requesting various changes in the maps are listed in Table 5-20. A majority of the sample evaluating the RMB map desired to see relief represented in the map. About 44% felt that the map should include descriptive text. Grids to locate points of interest more easily and a more complete legend were desired in both the maps.

Table 5-19: Ratings for the Information Content of the RMB and RMC Maps

Q: Rate the information content of the map on the scale below

		Excessive			Inadequate	
		<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>
<hr/>						
Percentage of						
sample (no.)	RMB	0%(0)	21%(7)	41%(14)	35%(12)	3%(1)
	RMC	0%(0)	15%(5)	53%(18)	26%(9)	6%(2)

Table 5-20: Desired Changes in the RMB and RMC Maps

Q: You would like to see the following changes in the map of the park:

	Percentage of sample (no.)	
	RMB	RMC
<hr/>		
a. The map should show relief or topography	53%(18)	15%(5)
b. The map should show relief or topography in more detail	35%(12)	41%(14)
c. The map should show more hiking trails	18%(6)	15%(5)
d. The hiking trails should be shown on a separate map	30%(10)	20%(7)
e. There should be a descriptive text of the Park with the map	44%(15)	24%(8)

Table 5-20, Continued

f. Other:

(RMB)

"More details of trails. . . .
 Level of difficulty of trails. . . .
 How long to travel trails. . . .
 Better use of colors. . . .
 The colour should be changed--its drab. . . .
 More information on the park's cultural and
 natural history. . . .
 A more prominent legend. . . .
 Complete list of symbols. . . .
 The map key should be set off from the map. . . .
 The legend could be more organized. . . .
 Insets of points which need more detail. . .
 More clearly defined road networks and
 capabilities of roads. . . .
 Road description in more detail. . . .
 A grid to find locations. . . .
 Distance marking on the roads and trails. . . .
 Suggest two maps--a) car tourist map with little
 trail detail b) trail map showing topography, etc."

(RMC)

"Relief or topography by contours. . . .
 Miles should be indicated between points on the map. .
 Different color for the hiking trails. . . .
 Difficulty levels of trails, elevation climbs
 on hiking trails. . . .
 Change size of names of peaks. . . .
 Complete key to symbols. . . .
 Should have locational guide with list of names. . . .
 Should provide a layered grid and index for
 finding points of interest more easily. . . .
 Clearer warnings and regulations. . . .
 More eye-catching pictures. . . ."

The readability of the three maps (BNP, RMB, and RMC) seems to relate to the graphic characteristics of the map elements. One of the requirements in a park map is that it should be quick and easy to read under various conditions of both illumination and situation. Visual contrast (line weights or colour) especially in differentiating roads and trails as well as highlighting points and places of interest is important. These need to stand out. The symbols themselves must be easily recognizable, preferably without the help of a legend.

There are two levels of information in a park map: natural or physiographic (peaks, rivers, lakes) and cultural (roads, trails, campgrounds, points of interest). In a national park, the physical features often become the points of interest (mountain peaks, waterfalls, geysers, arches) and these may be designated either as points, or the physiography may be shown as continuous surface information. How well was the physiographic information perceived and how correctly did the survey population interpret it?

There is little relief portrayal on the BNP map. The need for this kind of information was felt: 79% of the population requested that the map show such information (You would like to see the following changes in the map of the park, Tables 3-8 & 3-14). Relief is shown as spot heights in the RMB map and as terrain shading in the RMC map which also uses colour to differentiate glaciers and hydrographic features. Percent correct identifications (Fig. 15) for questions relating to physiographic information shows differences in the readability of the different symbols. For the majority of the questions, the percent correct identifications all lie between 70 and 98 percent. On a comparative level, the terrain shading seems to

have been a definite help in determining a ridgeline or identifying visibility range for identifying peaks from a particular location. It seems to have made no difference in the determination of direction of river flow or the slope of the road.

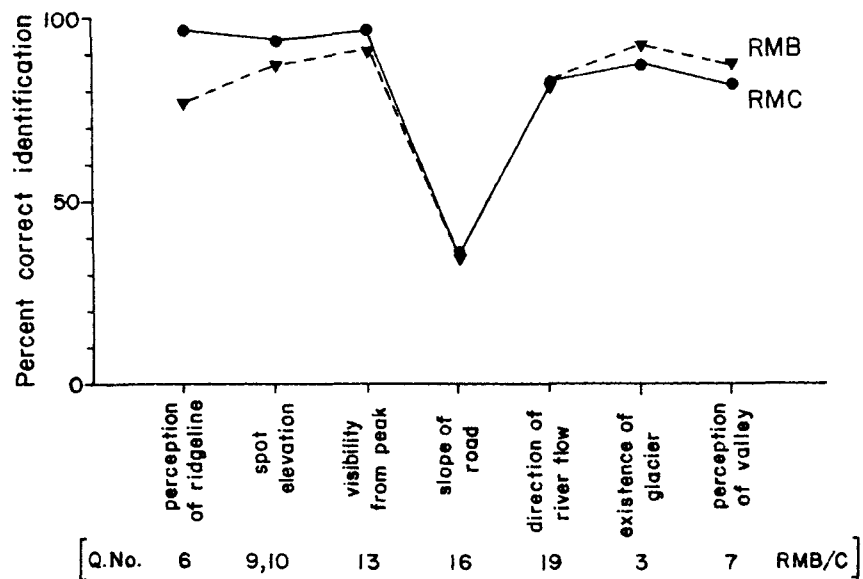


Fig.15 Percent correct identification of physical information.

Contradictorily, the percent correct identification of a valley in the RMC map falls below the RMB level (Q.7). The location of peaks and the reading of their elevations in both the RMB and RMC maps is definitely influenced by the size of the print. The use of both the meter and the mile, especially with the units stated in the legend also caused confusion. A high percentage of the population (97%) identified that the given section of the Trail Ridge Road followed the ridgeline (in the RMC map), yet only 35% could identify the slope of the road in another section of the same map. This lack of any agreement makes it difficult to draw major conclusions. The terrain shading certainly enhances the 'look' of the map and helps fill in the empty spaces that might have otherwise occurred on the RMC map,

especially in areas which do not have much accessibility. As a technically useful part of the map, however, where the user may need to determine the steepness of roads or trails, it leaves much to be desired.

Cultural information (roads, hiking trails, scenic viewpoints, campgrounds, services, and recreational opportunities) is a commonly sought after information on a park map. Visitors need to know how to get around the park or where the facilities and services are located. Percent correct answers to questions relating to such information are shown in Figure 16.

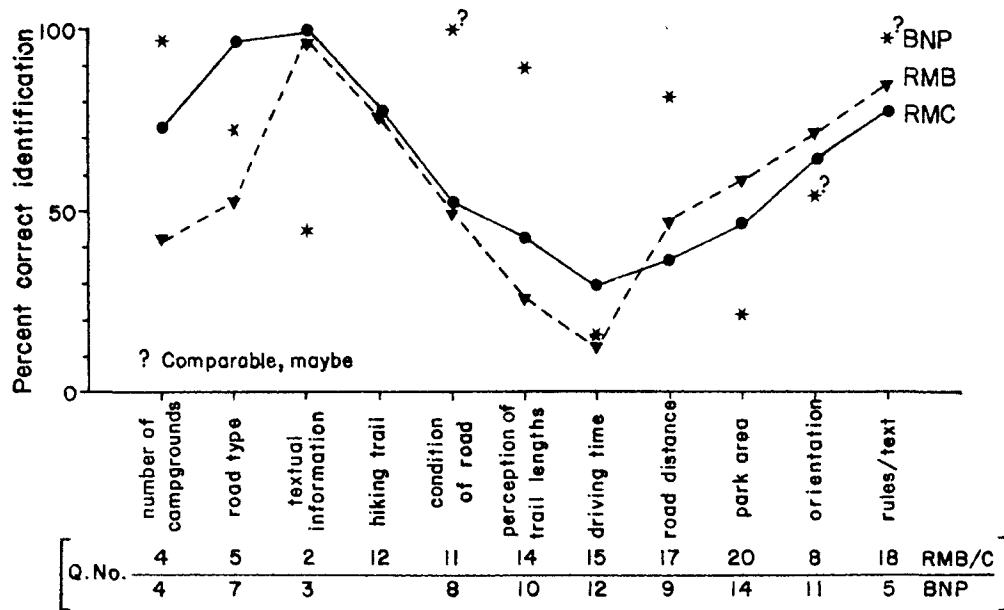


Fig.16 Percent correct identification of cultural information.

The use of contrasting colours is an asset to any map; its readability and interpretation, however, is influenced by its representation in the legend--the readers need to know what the different colours stand for. The colours used in the BNP map space are clear and differentiable, but its representation in the legend is

poor. The corresponding identifications are low (Q.3), the colours often being reversed by the reader.

In the differentiation of road types, the readability distinctly correlates to the use of bolder visual contrasts. A majority of the sample (97%) was able to correctly differentiate paved roads on the RMC map (Q.5); the corresponding figures for the RMB and BNP (Q.7) maps were 53% and 73% respectively. The ability to identify the road to the Long's Peak Trailhead was poor on both the RMB and RMC maps (50 and 52% respectively).

The perception of lengths of trails and the measurement of distances along roads is poorer on both the RMC and the RMB map than on the BNP map. The performance on the BNP map is obviously higher because distances are cited verbatim between points along the road; however, the use of both the meter and the mile caused some confusion. The RMB and RMC maps fared rather poorly in this respect (Q.17), maybe due to the inability of the population to make such measurements and partly due to the confusion existing over the identity of one of the destination points (Rainbow Curve). This emphasizes the need for information to be clearly coded. For quick and easy reading, the distances should to be stated verbatim between points of interest.

The perception of the lengths of trails (Q.10, BNP and Q.14, RMB and RMC) also seems to have been influenced by the clarity and legibility of the map elements. In the BNP map, which has little or no background information, 80% of the population was able to judge the comparative lengths of the trails correctly. The RMC map produced a slightly higher percentage of correct identifications of

the trail lengths than the RMB map (Q.14). It should be noted, however, that part of the sample derived the answers from the text in the RMC folder where the trail lengths were cited verbatim. The comparative complexity of the Rocky Mountain maps also caused a problem when users sought information specifically in regard to the park, only 41% were able to locate the correct number of campgrounds *within* the park.

The symbols used by the National Park Service for designating services and recreational facilities is standardized and carefully designed, its recognition level is fairly high. The results, however, emphasized the need for a detailed and prominently placed legend.⁸¹

Finally, where the information had to be derived secondarily from the map, e.g. driving times between points of interest, the population fared poorly on all three maps. This may be attributed to the inability of the population to perform simple mathematical calculations!

The technical features of the map, the folding, the material and size also need be assessed. The following are observations from the survey sample:

"The most frustration I have ever had with a map is getting it folded back up again." (RMC)

"My biggest problem is folding this map." (RMC)

"I find the map terrible under artificial lighting due to the glossy finish which causes reflections and makes it very difficult to read." (RMC)

"The size is not readily usable for storage or for laying on a dashboard." (RMB)

The needs for information in park maps varied among the sample population.

⁸¹See page 71

Orientation to unfamiliar surroundings and the location of facilities and services were cited by the park officials as the major objective of the park map. What did the sample consider to be the purpose of the park maps? The clear and concise location of service facilities appears to be the most important requirement on a park map.⁸² Physiographic detail, points of interest ("what there is to see and do"), and hiking trails were also cited by the sample as important information needed to be conveyed by the Park maps. While wanting "great detail of all available information on the Parks", the majority of the sample realized the need to "keep it (the map) simple". This was a common refrain. The map should, therefore, provide "detailed description and geographical location of all points of interest and services" . . . "that's interesting to everyone and understood by most".⁸³

An important requirement also seems to be that the visitor be given a *choice to make his decision* about where he wants to go and what he wants to do. While some of the sample felt that the map needed to be directed at the 'auto traveler' and the 'average American', a majority did desire details of backcountry hikes and campgrounds. A solution suggested by a survey participant was that one map be directed at the tourists in autos to find their way through the park and find accommodations; a second map should be available to show hiking trails to be used by people not in cars. The folder must also provide information to keep the visitor safe. The sample also suggested that maps be used for the administration and

⁸²This clearly matches the objective cited by Mr. Von Allmen, Senior Cartographer, NPS. See Chapter 3, page 31

⁸³Quote from survey participant.

protection of the park(s) by informing the public of the value of the environment or by discouraging or encouraging the use of particular areas or facilities. Historical and cultural information as well as information on the flora and fauna would also be welcomed. The map should also justify a visit to a park and emphasize the unique features of the area.

One cannot of course make a map to satisfy *everybody's* needs; the mapper can at best aim to make the map readable and useful to a majority of the users. The information content and the degree of detail present the three units of analysis vary; all are rated almost equally on the adequacy scale (See Tables 5-13 & 5-19). It does not seem to matter how much detail is present in a map as long as it is "comprehensible to an average unskilled reader".⁸⁴

The survey participants were finally asked to cite any experiences they may have had with national park maps. Some quotes from the survey are given in appendix C.

⁸⁴Quote from survey.

Chapter 6

SUMMARY AND CONCLUSIONS

Summary

Yellowstone National Park was once referred to as a "great breathing place for the national lungs."⁸⁵ Today, millions of people flock to the several breathing places in the nation. National parks are all areas of exceptional scenic beauty, and sightseeing is a major activity. Hiking, camping, and other outdoor activities are also popular. The environment provides the primary source of enjoyment.

Linking the environment and the user together are the various interpretive programmes and informational publications that are available to visitors to a park. "Do you have a map of the area?" is one of the most commonly asked questions in the parks.⁸⁶ A map and an information handout is generally given out free at the entrance station to a park. These vary from cheap mimeographed versions to larger multicolour productions. The descriptive park folder, produced by the National Park Service, devotes up to half its space to a map of the park, aimed to help visitors orient themselves to unfamiliar surroundings. It also provides locational information about the various recreational and service facilities available

⁸⁵George Vest of Missouri, cited by Freeman Tilden, National Parks, p. 22.

⁸⁶Sharpe, Interpreting the Environment, p. 166.

in the park.

The park map is part of a unique communication system. The thesis considered all the elements of the system: the objectives of the mapper, the nature of the parks themselves, and the abilities of the users in regard to their map reading skills. The major objective of the thesis was to evaluate the park map, especially its readability. There is, however, no single representative map of the national parks in the country. It was not possible within the scope of this study to analyze all of the maps of all the 48 national parks. The Rocky Mountain Region, under the administrative realm of the National Park Service, was chosen as a sample area for the thesis. This region comprises 13 national parks of differing physical and cultural environments. All the parks make a National Park Service folder available to their visitors; the larger parks of the study area (Glacier, Grand Teton, Yellowstone, and Rocky Mountain national parks) also use monochrome or duochrome version of the larger multicolour map found in the folders. A total of 16 maps were therefore considered for the study. The maps were classified on the basis of their information content, their graphic representation, and appearances into three categories or types: simple park folders, tear off sheets and complex park folders. A representative map was chosen from each category for evaluation. The maps from the latter two categories are alternative versions of the same map and were evaluated for their comparative readability.

The study used a task-oriented approach where 101 voluntary students of the University of Montana answered a questionnaire developed for the purposes of evaluation. The major part of the evaluation involved determining the readability of

the park maps through locating, verifying and interpreting the various map symbols; the questionnaire also elicited reader opinions on the appearance and information content of the maps and folders. The evaluation was preceded by a Map Reading Acuity Test which was aimed at determining an individual's ability to read maps in general. The samples' map reading acuity was later correlated to the performances on the park maps to see if any relationship existed between an individual's map reading ability and his performance on a particular park map. The park maps are directed at a very general audience, a portion of which may have no skills in map reading. Is there a correlation between a person's map reading skills and the readability of the park maps? Can anybody read a park map?

Conclusions

Three specific maps belonging to two particular parks were analyzed in the thesis. If a participant was confused as to which part of the road formed the Rainbow Curve in the Rocky Mountain folder, this must pertain to the map of that park alone. The general weaknesses and strengths, however, may be applied to maps of all the national parks.

The results of the survey indicate that the overall impressions of the park folders are favourable. The park folders are all pleasing in appearance--especially so the multicolour productions. Descriptive text including additional photographs is an asset; it helped a majority of the sample to form a favourable cognitive image of the park. The 'look' of the map is important--the multicolour productions mostly encouraged the readers to visit the parks; the duochrome map, with no additional

information but text in the form of rules and regulations, was often considered discouraging. In addition to 'utility', 'beauty' for a park map certainly deserves attention.

The range of contents of the park maps is diverse, varying from a simple representation of points and places of interest along the major roads in the simple park folders to continuous surface information on the complex park folders. The quantity and type of information that is incorporated in the park maps are generally determined by the individual park administrators to suit the needs of the particular parks. Interestingly enough, the information content in all three park maps studied received similar mean ratings (very slightly on the inadequacy side of the scale) from the survey sample.

The needs of the population are many and varied. Judging from the study, however, there seem to be two distinct types of visitors to the national parks--the automobile traveller, and the backcountry hiker. The current park maps appear to be directed at the average automobile traveller (visitors who are generally 'driving through' the park without getting off the regular highways and main thoroughfares) and, according to reader opinion, has been adequate for this type of travel. For some survey participants who had sought information beyond the highways and popular sightseeing places in the parks, the map had proved inadequate.

Based on the performances of the sample on the three park maps, it seems reasonable to conclude that the maps of the parks are fairly readable. Over 70 percent of questions asked were answered correctly on all three maps. The readability of the maps seemed to correlate to the graphic designs of the

elements. Information cited verbatim on the map (distances along roads, heights of peaks, etc.) or in the text (lengths of trails, number of campgrounds, etc.) and the symbols used by the National Park Service to represent recreational and service facilities were read correctly by a majority of the participants. Where the map symbols were poorly depicted in terms of visual contrast or legibility, performance by the sample was poor. The sample also performed poorly where the information had to be derived secondarily from the given information in the map--determining driving times between places, determining direction, or measuring distances. On a comparative level, the multicolour map (complex park folder) had a better readability than its duochrome counterpart. The t-test performed on the mean readability scores of the two maps showed a significant difference in their readabilities.

The study definitely shows that more attention needs to be paid in the park maps to the basics in graphic design: clear type, clear symbols, clean colour differentiation, and bolder visual contrast. Ease of use and legibility are clearly requirements, especially since the map is used very commonly inside a moving car. And, above all, the map needs to be simple. The correlation between an individual's map reading acuity and his performance on the park map showed that only a weak relationship existed between the two variables when encountering the simplest form of the park map; previous training in map reading seemed to be an aid when encountering the more complex versions of the park maps. The map should also include a prominently placed legend. Even though tourist maps require that symbols have forms which allow them to be read without the help of a legend and

the National Park Service uses a carefully designed system of symbols, the plea for "more instructions on how to read the map" from the survey sample speaks for the need for more attention to be paid to this aspect of map design.

The effectiveness of the park map must be judged by its objective. The needs of the visitors to the parks have been well anticipated by the National Park Service. The user almost always seeks the location of the various facilities and recreational opportunities; he will use the map to plan how to get from one place to another and to decide how he wants to spend his time in the park. A proportion of the population will desire to get off the major highways and seek information on hiking trails and backcountry campgrounds. The existing park maps will give the visitor a fair idea of what the park is like (more so if he buys a colour folder) and will tell him what there is to see and do. But, judging by the readability level of the symbols, when he chooses to look for details like actual distances or level of difficulty of trails, or when trying to decide if the road to a particular place is accessible with his car, or if the road is too steep and high for his physical condition, the map may disappoint him.

One must realize, of course, that the map is not the only tool that helps a visitor navigate or interpret the park; road signs, rangers, interpreters, and more detailed topographic maps are available to answer his questions. The question then becomes: can the average visitor be expected to read a topographic map or must he pay to buy a map which will still not answer his questions. . . .

A map will seldom satisfy the needs of all its users; it may, however, aim to satisfy a majority of them. The study evaluated national park maps mainly in

regard to their readability and was not aimed at developing a design concept for them. It appears, however, that two aspects of mapping need to be kept in mind when designing maps for national parks:

(1) The range of contents. Though this is largely determined by the park authorities to suit the needs of the individual parks, it should be such that the need for a number of separate maps is minimized. To determine user needs for information on maps, surveys of park visitors need to be conducted. If conclusions are to be drawn from the study, the degree of detail of information seems to make little difference if the map is intelligible and easy to read.

The nature of parks themselves must determine what is to be mapped. National parks are areas of physical beauty and natural wonder: the mapping of the physiography is important. A majority of the sample studied did desire to see more detailed representation of the topography. While one may conclude from the study that detailed backcountry information is desirable on the maps, this must be viewed in light of the fact that the surveyed sample may represent only a fraction of the population that visits national parks. A survey of actual park visitors conducted within a park may be desirable. An important requirement expressed by a large number of the survey participants seems to be that the visitor be given a choice to make his decision about what to see and do in the park--the park maps do need to present their visitors with a great detail of information on what there is in the parks.

(2) The graphic design. The design should be such that an average unskilled reader will be able to use the map. The general composition of the map should

also take into consideration the format and material of the maps; park maps are commonly used under conditions of dim illumination and cramped conditions in the interior of the car. Systematic studies of alternate designs may be useful in increasing the quality and utility of the park maps.

An important factor in the production of any map is cost; it may not be possible to produce a newly designed map for national parks. It does not seem necessary that this is done immediately; the current maps, however, do have room for improvement.

The study is an 'armchair' evaluation of national park maps. While determining the readability of maps under laboratory conditions may not be the best method of judging the effectiveness of the park maps, it is certainly a beginning. Ideally perhaps the map will be best evaluated under actual field conditions and by surveys conducted of users of the maps within the parks. The study, however, does bring to light the strengths and weaknesses of the current park maps. This will hopefully be reinforced by further studies in the field.

APPENDIX A: SURVEY QUESTIONNAIRE

Name _____

Address/Phone Number _____

Student Status: Frosh _____ Soph _____ Jr _____ Sr _____ Grad _____

Grad non-degree _____ Other (specify) _____

Major field of study _____

Do you wear glasses (prescribed)? _____

Are you colour blind? Yes _____ No _____ Do not know _____

Have you had any instructions in map reading? Yes _____ No _____

If yes, list courses and when taken:

Courses	Year
_____	_____
_____	_____
_____	_____
_____	_____

Other experiences (military, scouts, etc.) Specify:

How often do you use the following maps? (Check those applicable):

	Very Often	Quite Often	Often	Rarely	Not at All
Road maps	_____	_____	_____	_____	_____
City maps	_____	_____	_____	_____	_____
Topographic maps	_____	_____	_____	_____	_____
General Atlas maps	_____	_____	_____	_____	_____
Special maps (geological, population, etc.)	_____	_____	_____	_____	_____
Recreation/tourist maps	_____	_____	_____	_____	_____
Maps in books	_____	_____	_____	_____	_____

Have you visited the following national parks? When did you last visit it?

Badlands National Park, South Dakota _____

Rocky Mountain National Park, Colorado _____

Have you visited any national park in the United States? Yes _____ No _____

PART I : MAP READING ACUITY

This is a survey conducted for a Master's thesis which is basically trying to evaluate the maps of national parks in this country.

The survey is divided into two parts. The first part of the survey deals with the map familiarity of an individual. There are three sections, and the directions for each section are printed separately. Once you have completed a section, PLEASE DO NOT GO BACK OR CHANGE THE ANSWERS. There is no time limit on the survey, but work as efficiently as possible. Do not linger too long on any one question. If you do not know the answer to one leave it blank.

Because participants will be using the same maps later, it will be greatly appreciated if you do not discuss the survey for the next several weeks.

Scales and protractors are provided to answer some of the questions.

Please turn to the next page

Should a map indicate a scale? Yes ____ No ____ Do not know ____

Should a map indicate direction? Yes ____ No ____ Do not know ____

Three methods are commonly used to express the scale of a map. Which is the most convenient of the three? (Check one):

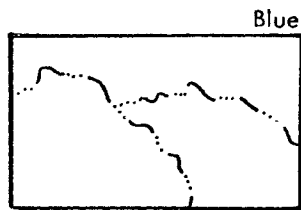
- a. Representative Fraction ____
- b. Graphic Scale (bar scale) ____
- c. Statement ____
- d. Do not know ____

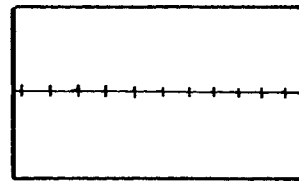
The U.S. Geological Survey commonly uses these four colours to symbolize features on its maps. Match the following symbols to their appropriate colours:

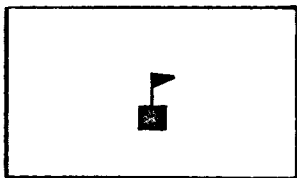
- a. Lakes and streams ____ brown
- b. Forests and orchards ____ black
- c. Countours and sand areas ____ green
- d. Railroads and trails ____ blue

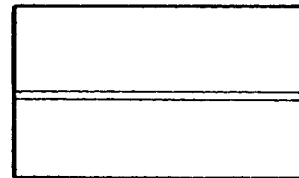
Please turn to the next page

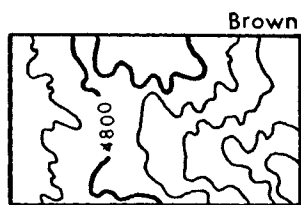
Maps use symbols to represent features that are found on the surface of the earth. What do the following symbols represent? (Answer in the space provided below):

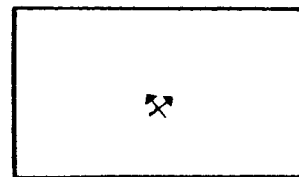












The following questions pertain to the map that has been handed out (U.S.G.S. Furnace Creek Quadrangle, 1:62,500).

What distance does one inch on the map represent on the ground?

One inch represents _____ inches

One inch represents _____ mile/s approximately

Give the straight line distance, in feet, between Mushroom Rock and
Zabriskie Point.

_____ feet

What is the elevation of Mushroom Rock?

Give the azimuth (degree reading) and direction from Mushroom Rock to
Zabriskie Point.

What is the magnetic compass azimuth from Mushroom Rock to Zabriskie Point?

What feature is located at the following coordinates? $116^{\circ} 48' 6''$ W,
 $36^{\circ} 16' 9''$ N

The road to Natural Bridge is (check one):

- a. downhill _____
- b. uphill _____
- c. level _____

Which of the following two mountain ranges has the gentler slope to the main valley?
(Check one):

- a. Panamint Range _____
- b. Black Mountains _____

Most of the valley lies (check one):

106

a. above sea level _____

b. at sea level _____

c. below sea level _____

There is some natural vegetation found on the map. It is associated with

(Check those applicable):

a. more rainfall in that part of the area _____

b. with the southern slopes of the mountains _____

c. areas below sea level _____

d. springs that feed into an alluvial fan _____

e. irrigation from the Furnace Creek Ranch _____

What is the major land feature shown on this quadrangle?

End of Part I of Survey

Name _____

Map Code ENP

Case No. _____

Please fill in your name in the above space

PART II: PARK MAP EVALUATION

This part of the survey involves the map of Badlands National Park. The park folder is available to visitors to the park. The questions in the survey pertain to both the map and the written text in the folder.

There is no time limit on this part of the survey either, but work as efficiently as possible. Do not linger too long on any one question; if you do not know the answer to one leave it blank.

Because participants will be using the folder later, please do not mark it any way. It will also be greatly appreciated if you do not discuss the survey for the next several weeks.

THANK YOU FOR YOUR TIME AND PARTICIPATION IN THE SURVEY. I DO APPRECIATE YOUR HELP.

Please turn to the next page.

N.B. The figures appearing on the left hand side of the numbered questions in the questionnaire represent the percentage (number) of correct answers for each question. The questions were not numbered in the original form, but have been added here to make it convenient for the reader to refer to them from the text. The type size has been changed to meet binding specifications. Everything else is as in the questionnaire used for the survey.

Have you used this particular map before?

108

Yes ____ No ____

Rate the general appearance of the FOLDER on the scale below (check one):

Attractive

Unattractive

5 4 3 2 1

Rate the general appearance of the MAP on the scale below (check one):

Clear

Complex

5 4 3 2 1

What do the following symbols represent? (Answer in the space provided below):



90.9 (30)



100.0 (33)

1a. _____

1b. _____



1c. _____

1d. _____



1e. _____

1f. _____

2. What do the following colours represent? 109
- a. Light orange _____ 33.3 (11)
- b. Brown _____ 66.7 (22)
3. There are no cabins or meals available in the park.
- True ____ False ____ 45.5 (15)
4. How many campgrounds are there in the park?
- _____ 96.9 (32)
5. Bison may be seen in the Sage Creek area of the park.
- True ____ False ____ 96.9 (32)
6. Part of the park lies in the Pine Ridge Indian Reservation.
- True ____ False ____ 100.0 (33)
7. The road from the Cedar Pass Visitor Center to Prairie Dog Town through Badlands Loop is all paved.
- True ____ False ____ 72.7 (24)
8. One can drive route # 509 at all times.
- True ____ False ____ 100.0 (33)
9. The distance between Badlands Loop and Prairie Dog Town along the road is (check one):
- a. 7 miles ____ 81.8 (27)
- b. 8 miles ____
- c. 9 miles ____
10. A comparison between the Fossil Exhibit Trail and the Cliff Shelf Trail shows that (check one):
- a. the former is longer than the latter ____ 84.9 (28)
- b. the former is shorter than the latter ____
- c. they are about the same ____
11. Saddle Pass Trail is located about 3 miles northwest of the Cedar Pass Visitor Center.
- True ____ False ____ 54.6 (18)

Please turn to the next page

12. Assuming a speed of 35 m.p.h. and neglecting all other factors, 110
 how long will it take to drive from the Cedar Pass Visitor
 Center to Saddle Pass Trailhead? 21.2 (7)

13. Sage Creek flows (check one): 72.7 (24)

a. north-south	_____	
b. south-north	_____	
c. southwest-northeast	_____	

14. The area of the park is about (check one): 24.2 (8)

a. 380 sq. miles	_____	
b. 450 sq. miles	_____	
c. 500 sq.miles	_____	

15. The Stronghold Table in the South Unit of the park is
 (check one): 93.9 (31)

a. flat topped land feature	_____	
b. a table for picnicking	_____	
c. A steep walled canyon	_____	
d. a rolling hill	_____	

Rate the information content of the map on the scale below (check one):

Excessive		Inadequate
_____	_____	_____
5	4	3
	2	1

You found the extraction of information from the map (check one):

Very Difficult		Very Easy
_____	_____	_____
5	4	3
	2	1

The folder makes you want to visit the park.

111

Yes ____ No ____

Why? _____

This is in reference to the written text in the folder.

(Check those applicable):

- a. It appears interesting _____
- b. It appears helpful _____
- c. It seems to be of little relevance _____
- d. It is too long _____
- e. You feel written information should not be included with a map _____
- f. You do not pay much attention to written information in maps anyway _____

You would like to see the following CHANGES in the map of the park.

(Check only those you think apply to the map you have at hand, and to you):

- a. the map should show relief or topography _____
- b. the map should show relief or topography in more detail _____
- c. the hiking trails should be shown on a separate map _____
- d. there should be a descriptive text of the park with the map _____
- e. other (specify) _____
- f. other (specify) _____
- g. other (specify) _____

Please turn to the next page

What do you feel should be the major purpose served by national park maps?. (Answer in the space provided below; if you need more space, use the reverse side of the page).

In the space below, give any comments you might have regarding experiences with maps of national parks (any national park in the U.S.). Specify 1) the park(s), 2) what the map had to do with the pleasant/unpleasant experience.

Name _____

Map Code R11B

Case No. _____

Please fill in your name in the above space

PART II: PARK MAP EVALUATION

This part of the survey involves of the map of Rocky Mountain National Park. The park folder is available to visitors to the park. The questions in the survey pertain to both the map and the written text in the folder.

There is no time limit on this part of the survey either, but work as efficiently as possible. Do not linger too long on any one question; if you do not know the answer to one leave it blank.

Because participants will be using the folder later, please do not mark it any way. It will also be greatly appreciated if you do not discuss the survey for the next several weeks.

THANK YOU FOR YOUR TIME AND PARTICIPATION IN THE SURVEY. I DO APPRECIATE YOUR HELP.

Please turn to the next page.

Have you used this particular map before?

114

Yes ____ No ____

Rate the general appearance of the FOLDER on the scale below (check one):

Attractive

Unattractive

5 4 3 2 1

Rate the general appearance of the MAP on the scale below (check one):

Clear

Complex

5 4 3 2 1

What do the following symbols represent? (Answer in the space provided below):



1a. _____



1b. _____



1c. _____



1d. _____



1e. _____



1f. _____

2. There are no motels or hotels in the park.

115

True ____ False ____

3. There are no glaciers or ice fields in the park.

True ____ False ____

4. How many campgrounds are there in the park?

5. Trail Ridge Road is paved.

True ____ False ____

6. The section of Trail Ridge Road from Rock Cut to the
Gore Range Overlook follows the ridgeline.

True ____ False ____

7. Old Fall River Road for the most part runs through a valley.

True ____ False ____

8. You are standing at the Forest Canyon Overlook on Trail Ridge Road
and facing directly south. The Terra Tomah Mountain is approximately
55 degrees to your left.

True ____ False ____

9. What is the elevation of the following peaks?

a. Deer Mountain (near the Beaver Meadow Entrance Station)

_____ feet

b. Sundance Mountain (near Forest Canyon Overlook)

_____ feet

10. Longs peak is the highest peak in the park.

What is its elevation?

_____ feet

11. It is possible to drive to Longs Peak Trailhead.

True ____ False ____

Please turn to the next page

12. One can hike to Longs Peak from at least two trailheads in the park.

True ____ False ____

13. When you stand on Longs Peak, you should be able to see:
(check those applicable):

- a. Mount Meeker ____
- b. McHenry's Peak ____
- c. Chiefs Head Peak ____
- d. Mount Lady Washington ____
- e. Storm Peak ____

14. A comparison between the Bear Lake and the Sprague Lake Self-Guiding Nature Trails (south of the Moraine Park Visitor Center) shows that (check one):

- a. the former is longer than the latter ____
- b. the former is shorter than the latter ____
- c. they are the same ____

15. You are at the Rainbow Curve Overlook. Assuming a speed of 35 m.p.h. and neglecting all other factors, how long would it take to drive to the Many Parks Curve Overlook?

16. The road from Many Parks Curve to the Hidden Valley Ski area is (check one):

- a. uphill ____
- b. downhill ____
- c. almost level ____

17. The distance between Rainbow Curve and the Forest Canyon Overlook along the road is (check one):

- a. 2 miles ____
- b. 3 miles ____
- c. 4 miles ____

Please turn to the next page

18. Trail Ridge Road may be dangerous to persons with heart or other physical ailments.

117

True ____ False ____

19. Within the park, Big Thompson River runs from (check one):

- a. the northwest to the southeast ____
- b. the southeast to the northwest ____
- c. north to south ____

20. The area of the park is about (check one):

- a. 400 sq. miles ____
- b. 600 sq. miles ____
- c. 750 sq.miles ____

Rate the information content of the map on the scale below (check one):

Excessive

Inadequate

5 4 3 2 1

You found the extraction of information from the map (check one):

Very
Difficult

Very
Easy

5 4 3 2 1

Please turn to the next page

The folder makes you want to visit the park.

118

Yes ____ No ____

Why? _____

This is in reference to the written text in the folder.

(Check those applicable):

- a. It appears interesting _____
- b. It appears helpful _____
- c. It seems to be of little relevance _____
- d. It is too long _____
- e. You feel written information should not be
included with a map _____
- f. You do not pay much attention to written
information in maps anyway _____

You would like to see the following CHANGES in the map of the park.

(Check only those you think apply to the map you have at hand, and
to you):

- a. the map should show relief or topography _____
- b. the map should show relief or topography
in more detail _____
- c. the hiking trails should be shown on a
separate map _____
- d. there should be a descriptive text of the
park with the map _____
- e. other (specify) _____
- f. other (specify) _____
- g. other (specify) _____

Please turn to the next page

What do you feel should be the major purpose served by national park maps?. (Answer in the space provided below; if you need more space, use the reverse side of the page).

In the space below, give any comments you might have regarding experiences with maps of national parks (any national park in the U.S.). Specify 1) the park(s), 2) what the map had to do with the pleasant/unpleasant experience.

Name _____

Map Code RMC

Case No. _____

Please fill in your name in the above space

PART II: PARK MAP EVALUATION

This part of the survey involves of the map of Rocky Mountain National Park. The park folder is available to visitors to the park. The questions in the survey pertain to both the map and the written text in the folder.

There is no time limit on this part of the survey either, but work as efficiently as possible. Do not linger too long on any one question; if you do not know the answer to one leave it blank.

Because participants will be using the folder later, please do not mark it any way. It will also be greatly appreciated if you do not discuss the survey for the next several weeks.

THANK YOU FOR YOUR TIME AND PARTICIPATION IN THE SURVEY. I DO APPRECIATE YOUR HELP.

Please turn to the next page.

N.B. The figures appearing on the left hand side of the numbered questions in the questionnaire represent the percentage (number) of correct answers for each question. The lighter type face represents the scores attained on the RMB map and the bolder type face, the scores attained on the RMC map: 100 (34) [RMB]

100 (34) [RMC]

The questions were not numbered in the original form, but have been added here to make it convenient for the reader to refer to them from the text. The type size has been changed to meet binding specifications. Everything else is as in the questionnaire used for the survey.

Have you used this particular map before?

121

Yes ____ No ____

Rate the general appearance of the FOLDER on the scale below (check one):

Attractive

Unattractive

5 4 3 2 1

Rate the general appearance of the MAP on the scale below (check one):

Clear

Complex

5 4 3 2 1

What do the following symbols represent? (Answer in the space provided below):



97.1 (33)

97.1 (33)



100.0 (34)

100.0 (34)

1a. _____

1b. _____



1c. _____



1d. _____



1e. _____



58.8 (20)

85.3 (29)

1f. _____

2. There are no motels or hotels in the park. 97.1 (33)
 True ____ False ____ 100.0 (34)
3. There are no glaciers or ice fields in the park. 91.2 (31)
 True ____ False ____ 88.2 (30)
4. How many campgrounds are there in the park? 41.2 (14)
 _____ 73.5 (25)
5. Trail Ridge Road is paved. 52.9 (18)
 True ____ False ____ 97.1 (33)
6. The section of Trail Ridge Road from Rock Cut to the
 Gore Range Overlook follows the ridgeline. 76.5 (26)
 True ____ False ____ 97.1 (33)
7. Old Fall River Road for the most part runs through a valley. 88.2 (30)
 True ____ False ____ 76.5 (26)
8. You are standing at the Forest Canyon Overlook on Trail Ridge Road
 and facing directly south. The Terra Tomah Mountain is approximately
 55 degrees to your left. 70.6 (24)
 True ____ False ____ 64.7 (22)
9. What is the elevation of the following peaks?
 a. Deer Mountain (near the Beaver Meadow Entrance Station) 82.4 (28)
 _____ feet 94.1 (32)
 b. Sundance Mountain (near Forest Canyon Overlook) 94.1 (32)
 _____ feet 94.1 (32)
10. Longs peak is the highest peak in the park.
 What is its elevation? 85.3 (29)
 _____ feet 94.1 (32)
11. It is possible to drive to Longs Peak Trailhead. 50.0 (17)
 True ____ False ____ 52.9 (18)
12. One can hike to Longs Peak from at least two trailheads
 in the park. 76.5 (26)
 True ____ False ____ 79.1 (27)

Please turn to the next page

13. When you stand on Longs Peak, you should be able to see:

(check those applicable):

a. Mount Meeker	_____	97.1 (33)	97.1 (33)
b. McHenry's Peak	_____	82.4 (28)	82.4 (28)
c. Chiefs Head Peak	_____	91.2 (31)	100.0 (34)
d. Mount Lady Washington	_____	94.1 (32)	100.0 (34)
e. Storm Peak	_____	94.1 (32)	100.0 (34)

14. A comparison between the Bear Lake and the Sprague Lake

Self-Guiding Nature Trails (south of the Moraine Park

Visitor Center) shows that (check one):

26.5 (9)

a. the former is longer than the latter	_____	44.1 (15)
b. the former is shorter than the latter	_____	
c. they are the same	_____	

Without changing the answer to the above question, please state
how you derived the answer:

a. from the map	_____	46.7 (7)
b. from the information in the folder	_____	53.3 (8)

15. You are at the Rainbow Curve Overlook. Assuming a speed of
35 m.p.h. and neglecting all other factors, how long would
it take to drive to the Many Parks Curve Overlook?

11.8 (4)

29.4 (10)

16. The road from Many Parks Curve to the Hidden Valley Ski
area is (check one):

35.3 (12)

a. uphill	_____	35.3 (12)
b. downhill	_____	
c. almost level	_____	

17. The distance between Rainbow Curve and the Forest Canyon
Overlook along the road is (check one):

47.1 (16)

a. 2 miles	_____	38.2 (13)
b. 3 miles	_____	
c. 4 miles	_____	

18. Trail Ridge Road may be dangerous to persons with heart or other physical ailments.

85.3 (29)

True ____ False ____

79.4 (27)

19. Within the park, Big Thompson River runs from (check one):

a. the northwest to the southeast ____

82.4 (28)

b. the southeast to the northwest ____

82.4 (28)

c. north to south ____

20. The area of the park is about (check one):

58.8 (20)

a. 400 sq. miles ____

47.1 (16)

b. 600 sq. miles ____

c. 750 sq.miles ____

21. What do the following colours represent?

a. Dark green _____

82.4 (28)

b. Blue _____

97.1 (33)

Rate the information content of the map on the scale below (check one):

Excessive

Inadequate

5 4 3 2 1

You found the extraction of information from the map (check one):

Very
DifficultVery
Easy

5 4 3 2 1

The folder makes you want to visit the park.

Yes ____ No ____

Why? _____

This is in reference to the written text in the folder.

(Check those applicable):

- a. It appears interesting _____
- b. It appears helpful _____
- c. It seems to be of little relevance _____
- d. It is too long _____
- e. You feel written information should not be
included with a map _____
- f. You do not pay much attention to written
information in maps anyway _____

You would like to see the following CHANGES in the map of the park.

(Check only those you think apply to the map you have at hand, and
to you):

- a. the map should show relief or topography _____
- b. the map should show relief or topography
in more detail _____
- c. the hiking trails should be shown on a
separate map _____
- d. there should be a descriptive text of the
park with the map _____
- e. other (specify) _____
- f. other (specify) _____
- g. other (specify) _____

Please turn to the next page

What do you feel should be the major purpose served by national park maps?. (Answer in the space provided below; if you need more space, use the reverse side of the page).

In the space below, give any comments you might have regarding experiences with maps of national parks (any national park in the U.S.). Specify 1) the park(s), 2) what the map had to do with the pleasant/unpleasant experience.

PARK OFFICIAL TELEPHONE INTERVIEW SCHEDULE

This is in reference to my earlier letters to you regarding the evaluation of maps of your park. The questions here refer to the 'free maps' distributed by your park at the entrance to the park, or at the visitor centers.

Q1. What is the purpose intended to be served by this map of your park?

(Some suggestions: navigation, orientation, names of features, facilities, interpretation, excite the curiosity of the visitor, plan to spend their time, educational)

Some supplementary questions:

Q2. Do you think the current map achieves this purpose?

Q3. Have there been any studies regarding the efficacy of these maps?

Q4. Have there been any complaints regarding the inadequacy of the maps? Anybody lost?

LIST OF INTERVIEWED PARK OFFICIALS

1. Superintendent, Arches, Canyonlands National Park.
2. Business Manager, Natural History Association, Badlands National Park.
3. Assistant Superintendent, Bryce Canyon National Park.
4. Superintendent, Capitol Reef National Park.
5. Chief of Interpretation, Glacier National Park.
6. Assistant Superintendent, Grand Teton National Park.
7. Superintendent, Mesa Verde National Park.
8. Chief Naturalist, Rocky Mountain National Park.
9. Chief Ranger, Theodore Roosevelt National Park.
10. Research Administrator, Yellowstone National Park.
11. Superintendent, Wind Cave National Park.
12. Chief Naturalist, Zion National Park.
13. Mr. William Von Allmen, Senior Cartographer, Division of Publications,
National Park Service, Harpers Ferry Center, Harpers Ferry, West Virginia.

APPENDIX B: SCORES AND STATISTICS

Table B-1: Sectional and Total Scores by Case Number for the Map Reading Acuity Test

Case No.	Sec. I	Sec. II	Sec. III	Total		Case No.	Sec. I	Sec. II	Sec. III	Total
1	5.0	5.0	11.0	21.0		26	4.0	3.0	6.0	13.0
2	4.0	4.0	7.5	15.5		27	4.0	4.0	6.5	14.5
3	5.0	2.0	5.5	12.5		28	3.0	4.0	8.0	15.0
4	5.0	4.0	9.0	18.0		29	5.0	5.0	10.0	20.0
5	5.0	6.0	9.5	20.5		30	5.0	4.0	7.5	16.5
6	5.0	5.0	8.0	18.0		31	5.0	5.0	3.5	13.5
7	5.0	5.0	10.0	20.0		32	5.0	4.0	11.0	20.0
8	5.0	4.0	5.0	14.0		33	5.0	5.0	9.5	19.5
9	4.0	1.5	3.5	9.0		34	5.0	4.0	7.5	16.5
10	4.0	4.0	8.5	16.5		35	5.0	6.0	7.0	18.0
11	5.0	6.0	11.0	22.0		36	5.0	5.0	9.0	19.0
12	4.0	2.0	7.5	13.5		37	5.0	2.0	3.0	10.0
13	3.0	3.0	3.5	9.5		38	4.0	6.0	8.0	18.0
14	5.0	6.0	7.0	18.0		39	5.0	3.0	2.5	10.5
15	4.0	3.5	6.5	14.0		40	5.0	4.0	6.0	15.0
16	5.0	3.5	8.0	16.5		41	4.0	3.0	7.5	14.5
17	5.0	4.0	5.5	14.5		42	5.0	4.0	7.5	16.5
18	5.0	4.0	4.0	13.0		43	4.0	3.0	4.0	11.0
19	4.0	4.0	8.5	16.5		44	5.0	5.0	9.0	19.0
20	4.0	6.0	11.5	21.5		45	5.0	3.0	4.5	12.5
21	5.0	6.0	8.5	19.5		46	3.0	1.0	5.0	9.0
22	5.0	4.0	7.5	16.5		47	4.0	5.0	6.0	15.0
23	4.0	1.0	5.5	10.5		48	5.0	3.0	4.5	12.5
24	5.0	4.0	6.5	15.5		49	5.0	6.0	7.5	18.5
25	5.0	6.0	7.5	18.5		50	5.0	3.5	8.0	16.5

Table B-1: continued

Case No.	Sec. I	Sec. II	Sec. III	Total		Case No.	Sec. I	Sec. II	Sec. III	Total
51	5.0	3.0	3.5	11.5		77	5.0	3.5	5.5	14.0
52	5.0	3.5	7.5	16.0		78	5.0	6.0	7.0	18.0
53	5.0	6.0	8.5	19.5		79	5.0	6.0	10.0	21.0
54	5.0	4.0	8.0	17.0		80	5.0	5.5	7.5	18.0
55	4.0	6.0	9.0	19.0		81	4.0	2.0	6.0	12.0
56	4.0	4.0	9.5	17.5		82	5.0	4.0	6.0	15.0
57	4.0	6.0	9.0	19.0		83	5.0	5.0	8.0	18.0
58	5.0	6.0	9.5	20.5		84	5.0	3.5	7.5	16.0
59	5.0	3.5	8.5	17.0		85	5.0	4.0	5.5	14.5
60	4.0	4.0	5.5	13.5		86	4.0	3.0	2.5	9.5
61	5.0	3.5	5.5	14.0		87	5.0	3.0	6.0	14.0
62	5.0	5.0	8.5	18.5		88	5.0	3.0	3.5	11.5
63	5.0	5.0	11.0	21.0		89	5.0	3.5	7.0	15.5
64	5.0	3.0	7.0	15.0		90	4.0	3.0	7.0	14.0
65	5.0	4.0	8.5	17.5		91	4.0	4.0	8.0	16.0
66	5.0	5.5	7.5	17.5		92	5.0	4.0	7.0	16.0
67	4.0	2.0	6.0	12.0		93	4.0	4.0	6.5	14.5
68	5.0	4.0	6.0	15.0		94	4.0	3.0	5.5	12.5
69	5.0	3.5	5.0	13.5		95	5.0	6.0	9.5	20.5
70	5.0	3.0	8.0	16.0		96	5.0	0.0	3.5	8.5
71	5.0	4.0	8.0	17.0		97	5.0	3.0	7.5	15.5
72	5.0	3.5	9.5	18.0		98	5.0	4.0	2.0	11.0
73	5.0	6.0	7.5	18.5		99	5.0	6.0	9.5	20.5
74	5.0	2.0	8.5	15.5		100	5.0	3.5	8.0	16.5
75	5.0	4.0	9.0	18.0		101	5.0	3.0	5.5	13.5
76	5.0	2.0	5.5	12.5						

Table B-2: Frequency Distribution of Map Reading Acuity Scores

Score	Frequency	Percent	Cum Percent		Score	Frequency	Percent	Cum Percent
8.5	1	1.0	1.0		15.5	5	5.0	47.5
9.0	2	2.0	3.0		16.0	5	5.0	52.5
9.5	2	2.0	5.0		16.5	9	8.9	61.4
10.0	1	1.0	5.9		17.0	3	3.0	64.4
10.5	2	2.0	7.9		17.5	3	3.0	67.3
11.0	2	2.0	9.9		18.0	10	9.0	77.2
11.5	2	2.0	11.9		18.5	4	4.0	81.2
12.0	2	2.0	13.9		19.0	4	4.0	85.1
12.5	5	5.0	18.8		19.5	3	3.0	88.1
13.0	2	2.0	20.8		20.0	3	3.0	91.1
13.5	5	5.0	25.7		20.5	4	4.0	95.0
14.0	6	5.9	31.7		21.0	3	3.0	98.0
14.5	5	5.0	36.6		21.5	1	1.0	99.0
15.0	6	5.9	42.6		22.0	1	1.0	100.0

Maximum attainable score in Sec. I = 5.0; Sec. II = 6.0; Sec. III = 12.0; Total = 23.0

Table B-3: Some Statistical Measures for the Map Reading Acuity Test

Mean	15.787	Std Err	0.319	Median	16.000
Mode	18.000	Std Dev	3.203	Variance	10.262
Kurtosis	-0.561	Skewness	-0.255	Range	13.500
Minimum	8.500	Maximum	22.000	Sum	1594.500

95% confidence interval for the mean = 15.15, 16.42.

Valid cases 101 Missing cases 0

Table B-4: Map Reading Acuity Test Scores and Park Map Readability Scores by Case Number
For the Three Groups Reading the Three Park Maps BNP, RMB & RMC

BNP Group			RMB Group			RMC Group		
Case No.	MRAT	BNP	Case No.	MRAT	RMB	Case No.	MRAT	RMC
1	21.0	12.0	4	18.0	20.0	3	12.5	23.0 (2)*
2	15.5	11.0	5	20.5	24.0	8	14.0	20.0 (2)
7	20.0	16.0	6	18.0	20.0	12	13.5	17.0 (2)
17	14.5	12.0	9	9.0	17.0	13	9.5	18.0 (1)
19	16.5	13.0	10	16.5	23.0	14	18.0	23.0 (2)
20	21.5	12.0	11	22.0	23.0	15	14.0	20.0 (2)
23	10.5	10.0	18	13.0	19.0	16	16.5	25.0 (2)
26	13.0	11.0	24	15.5	17.0	21	19.5	25.0 (1)
34	16.5	13.0	27	14.5	13.0	22	16.5	22.0 (2)
35	18.0	12.0	28	15.0	22.0	25	18.5	20.0 (2)
37	10.0	11.0	31	13.5	12.0	29	20.0	25.0 (2)
40	15.0	11.0	32	20.0	22.0	30	16.5	23.0 (2)
46	9.0	13.0	33	19.5	25.0	38	18.0	19.0 (2)
49	18.5	12.0	36	19.0	23.0	43	11.0	18.0 (1)
50	16.5	13.0	39	10.5	14.0	45	12.5	20.0 (2)
53	19.5	10.0	41	14.5	22.0	47	15.0	20.0 (1)
56	17.5	14.0	42	16.5	20.0	51	11.5	21.0 (1)
57	19.0	12.0	44	19.0	20.0	54	17.0	21.0 (2)
60	13.5	12.0	48	12.5	18.0	55	19.0	18.0 (2)
61	14.0	12.0	52	16.0	19.0	58	20.5	22.0 (2)
65	17.5	10.0	62	18.5	18.0	59	17.0	25.0 (2)
67	12.0	14.0	64	15.0	18.0	63	21.0	26.0 (2)
69	13.5	13.0	71	17.0	17.0	66	17.5	21.0 (2)
72	18.0	13.0	73	18.5	22.0	68	15.0	21.0 (2)
76	12.5	13.0	77	14.0	18.0	70	16.0	21.0 (1)
80	18.0	14.0	78	18.0	25.0	74	15.5	25.0 (2)

Table B-4: continued

BNP Group			RMB Group			RMC Group		
Case No.	MRAT	BNP	Case No.	MRAT	RMB	Case No.	MRAT	RMC
82	15.0	10.0	79	21.0	23.0	75	18.0	21.0 (2)
83	18.0	14.0	86	9.5	22.0	81	12.0	20.0 (2)
84	16.0	12.0	87	14.0	20.0	85	14.5	21.0 (1)
90	14.0	15.0	88	11.5	18.0	92	16.0	24.0 (2)
95	20.5	16.0	89	15.5	20.0	93	14.5	18.0 (2)
96	8.5	13.0	91	16.0	19.0	97	15.5	20.0 (2)
98	11.0	9.0	94	12.5	19.0	99	20.5	22.0 (2)
			100	16.5	17.0	101	13.5	19.0 (2)

*Scores attained on questions 1-20 (score attained on Q.21).

Maximum score attainable on BNP = 17.0; RMB = 27.0; RMC = 27.0 (2)

BNP = Badlands National Park (folder)

RMB = Rocky Mountain Black (tear-off sheet)

RMC = Rocky Mountain Colour (folder)

MRAT = Map Reading Acuity Test

APPENDIX C: USER EXPERIENCES WITH NATIONAL PARK MAPS

SOME SELECTED QUOTES FROM THE SURVEY:

"I have visited many national parks including Yellowstone, Glacier, Teton, Grand Canyon, Mesa Verde, Bryce, and many more. In every case, the map served its purpose very well and made my trip more interesting and valuable informationwise. I particularly liked the Mesa Verde map guiding one through a Pueblo Indian village. The maps also serve as souvenirs of my trips. I have fond memories evoked each time I look them over. They bring back more memories than mere photographs or journal entries would."

"I have long appreciated maps published about the national parks. At age 13 I began a collection of maps put out by the National Park Service covering parks, monuments, recreation areas, and historical parks. The maps themselves heightened my curiosity about the NPS areas and of natural areas in general. A desire to visit these NPS areas developed after studying maps of the areas. (I acquired most maps by writing NPS headquarters in Washington)"

"The maps I have received at entry gates and information centers of parks have been more than sufficient to help me appreciate what I am seeing--names of park features, location of lodging, meals, restrooms, names of lakes, and short pertinent histories of people and places related to the area."

"I've visited many national parks, most recently Glacier. The map helped in several ways. First, it showed the more primitive campsites which I prefer. Second, it showed easily accessible trails since we were on a short trip. The rangers have been more than helpful in the past when I've wanted more challenging hikes. Third, it reminded me at a glance which overpopulated areas and tourist traps to avoid."

"In general my experiences with the park system have been very pleasant. The maps provided me with basic information so that I knew a little of the park's history, geography, ecosystem, weather, hazards, etc."

"Typically, the maps of Yellowstone, Glacier, and parks in the West Coast states show the basic information. They are uncluttered, easily read. They have information on points of interest. I like the ease with which you can find information on them. They are simple enough to look at in a glance. They enable you to drive without long stops, searching for points of interest."

"The map of Yellowstone park was very helpful. The map was clear and informative. I was traveling with children and no other reliable map reader was along. Sometimes I had to glance at the map quickly--it was very helpful!"

"I really have'nt dealt with too many maps from national parks. When I do, I am grateful they even have them. They are definitely a big help in learning about an unfamiliar area. A person would miss out on a lot of information without them."

"I have always been surprised at how much more spectacular the park is than the map illustrates. It makes the experience much more enjoyable--it's more fun to get more than you expected than less."

"All my experiences in national parks with maps have been good. I have had some trouble getting large scale topographic maps of some parks--Capitol Reef, Canyonlands. This made it difficult to plan backcountry trips before actually arriving at the park. I was in Capitol Reef National Park in March '85 and did not have a good topo map for the entire park. Another thing I ran into there was the lack of maps for any of the surrounding national parks. There appeared to be a lack of communication between the separate parks."

"Used one map published in National Geographic of Glacier National Park. We swamped our canoe, and needed to walk out for help. The map was not oriented north to the top of the page, but was slightly askew. We walked several extra hours and miles, paralleling the road we were searching for. (But we should have obtained a more detailed, appropriate map.)"

"I have used maps of Yellowstone, Glacier, Zion and the Petrified Forests. I remember that they all have the same appearance. I remember that none of them added to the pleasantness of my experiences. The discovery of my knowledge of these parks was done when I actually went through the parks. The maps were not very beneficial except for following the various routes."

"I have not had much experience with national park maps. Though I have been to many national parks, most travel through them was just 'driving through' the main highways. (No side trips, no overnight stays and no particular sights to see.) The map is adequate for this type of travel."

"Most (maps) are too sketchy, so we (my husband is the map reader on our trips) depend on U.S.G.S. topographic maps. Surely no hiker would depend on a NPS map!"

"I had a terrible experience in Yellowstone National Park two years ago. I felt the map and/or the literature should specify traffic flow. I was on a bicycle trying to enjoy the park and found out (that) the only time to ride was in twilight to avoid congestion."

". . . If road transit has been my aim, then I have found them (national park maps) helpful for services and such, but not at all as far as natural scenery and/or obstacles that nature may have placed in my route (when bicycling)."

"The maps are all too cluttered and difficult to figure out. . . . We often spent many frustrating hours trying to sort out how to get to a particular location and were often misled by the maps."

"Nine times out of ten the map was almost useless and I ended up going to the ranger station for direction, or asking other campers."

Selected Bibliography

- Aber, Ronald; Adams, John S.; and Gould, Peter. Spatial Organization: A Geographer's View of the World. Englewood Cliffs, N.J.: Prentice Hall Inc., 1971.
- Allmen, William Von. Senior Cartographer, Division of Publications, National Park Service, Harpers Ferry Center, Harpers Ferry, West Virginia. Telephone interview, April 10, 1985.
- Assistant Superintendent. Grand Teton National Park, Wyoming. Telephone interview, April 17, 1985.
- Babbie, Earl R. Survey Research Methods. Belmont, Ca.: Wordsworth Publishing Co. Inc., 1973.
- Balchin, W. G. V. "Graphicacy." Geography 57 (1972):185-95.
- Beckner, William C. "Living with the Land." Trends (April/May/June 1974):3-8.
- Board, C. "Maps as Models." In Models in Geography, pp. 671-725. Edited by R. Chorley and P Haggett. London: Methuen & Co. Ltd., 1967.
- Cameron, Jenks. The National Park Service: Its History, Activities and Organization. New York: D. Appleton and Co., 1922.
- Chao, Lincoln L. Statistics: Methods and Analyses. 2nd ed. New York: McGraw-Hill Book Co., 1974.
- Chief Naturalist. Zion National Park, Utah. Telephone interview, April 10, 1985.
- Clawson, Marion. Land and Water for Recreation: Opportunities, Problems and Policies. Resources for the Future Policy Background Series. Chicago: Rand McNally & Company, 1963.
- Everhart, William C. The National Park Service. Foreward by George B. Hartzog, Jr. New York: Praeger Publishers, 1972.
- Fisher, Frederic E. Fundamental Statistical Concepts. San Francisco: Canfield Press, 1973.

- Gleason, Vincent. "Signs for the Parklands." Trends. (Jan/Feb/March 1975):14-17.
- Harrington, Joseph D. "The Tourist Map of the United States needs a Great Designer." Proceedings of the American Congress on Surveying and Mapping, 34th Annual Meeting, St. Louis, Mo., March 10-15, 1974. pp. 553-59.
- Henry, Tom. Assistant Superintendent, Bryce Canyon National Park, Utah. Telephone Interview, April 10, 1985.
- Jensen, Clayne R. Outdoor Recreation in America: Trends, Problems and Opportunities. Minneapolis: Burgess Publishing Co., 1970.
- Johnston, Midge. Business Manager, Natural History Association, Badlands National Park, South Dakota. Telephone interview, April 10, 1985.
- Kaye, Glenn. Chief Naturalist, Rocky Mountain National Park, Colorado. Telephone interview, April 17, 1985.
- Lockwood, Clyde M. Chief of Interpretation, Glacier National Park, Montana. Telephone interview, April 16, 1985.
- Lutz, Gene M. Understanding Social Statistics. New York: Macmillan Publishing Co. Inc., 1983.
- McGrath, Gerald. "The Mapping of National Parks: A Methodological Approach." Cartographica Monograph 2 (1971):71-76.
- Morrison, Alastair. "Methods of Evaluating Motoring Maps." International Yearbook of Cartography 15 (1975):110-122.
- Mercer, David. "The Role of Perception in the Recreation Experience: A Review and Discussion." Journal of Leisure Research 3 (Fall 1971):261-272.
- Norcliffe, G.B. Inferential Statistics for Geographers. New York: John Wiley and Sons, 1977.
- Olson, Judy. "Improving Map Communication Through Task Relevant Experience." Proceedings of the American Congress on Surveying and Mapping, 34th Annual Meeting, St. Louis, Mo., March 10-15, 1974. p. 173.
- Omrod, R.K., and Tolahan, R.G. "Can Signs Help Visitors Control Their Own Behavior?" Trends 19 (1982):25-27.
- Ostrowski, Jerzy, and Ostrowski, Wieslaw. "Cartographic Conception of Tourist Maps of Towns." International Yearbook of Cartography 15 (1975):123-131.

- Outdoor Recreation Resources Review Commission. Outdoor Recreation for America: A Report to the President and to the Congress by the Outdoor Recreation Resources Review Commission. Washington, D.C.: Government Printing Office, 1962.
- O'Rourke, Barry. "Travel in the Recreational Experience: A Literature Review." Journal of Leisure Research 6 (Spring 1974):140-56.
- Parsons, John R. "The Role of the Map in the Recreation Experience." Master's thesis, University of Kansas, 1978.
- Petchenik, Barbara B. "A Verbal Approach to Characterizing the Look of Maps." The American Cartographer 1 (1974):63-71.
- Powell, Bob. Chief Ranger, Theodore Roosevelt National Park, North Dakota. Telephone interview, April 10, 1985.
- Ratajski, Lech. "Commission V of the I.C.A.: The Tasks it Faces." International Yearbook of Cartography 14 (1974):140-144.
- Reid, Leslie M. Outdoor Recreation Preferences: A Nationwide Study of User Desires. Thesis, University of Michigan, n.p.; reprint by the BJ Press, 1964.
- Research administrator. Yellowstone National Park, Wyoming-Montana. Telephone interview, April 17, 1985.
- Robinson, Arthur H. The Look of Maps: An Examination of Cartographic Design. Wisconsin: University of Wisconsin Press, 1952.
- _____. "The Uniqueness of the Map." The American Cartographer 5 (1978):5-7.
- Robinson, Arthur H., and Petchenik, Barbara B. The Nature of Maps: Essays Towards Understanding Maps and Mapping. Chicago: University of Chicago Press, 1976.
- Robinson, Arthur H.; Sale, Randall; and Morrison, Joel. The Elements of Cartography. New York: John Wiley and Sons, 1978.
- Sharpe, Grant W. Interpreting the Environment. 2nd ed. New York: John Wiley and Sons, 1982.
- Smith, Carlos A. "A Test Concerning the Relative Readability of Topographic and Orthophotomaps." The American Cartographer 4 (1977):133-143.

Superintendent. Arches, and Canyonlands National Park, Utah. Telephone interview, April 15, 1985.

Superintendent. Capitol Reef National Park, Utah. Telephone interview, April 15, 1985.

Superintendent. Mesa Verde National Park, Colorado. Telephone interview, April 15, 1985.

Superintendent. Wind Cave National Park, South Dakota. Telephone interview, April 10, 1985.

Taylor, R. M. "Information Theory and Map Evaluation." International Yearbook of Cartography 15 (1975):165-180.

Tilden, Freeman. The National Parks. Foreward by George B. Hartzog Jr. 2nd rev. ed. New York: Alfred A. Knopf, 1970.

_____. "Principles of Interpretation." Trends (April/May/June 1974):1.

U.S. Department of the Interior, National Park Service. Parks for America: A Survey of Park and Related Resources in the Fifty States, and a Preliminary Plan. Washington, D.C.: Government Printing Office, 1967.

_____. Preserving Our Natural Heritage, vol. I: Federal Activities. Washington, D.C.: Government Printing Office, 1975(?).

U.S. Department of the Interior, National Park Service, Branch of Statistics Analysis. Public Use of the National Parks: A Statistical Report, December 1964, December 1966, December 1968.

_____. Public Use of the National Parks, December 1970, December 1972.

_____. Public Use of the National Park System: Calender Year Report, 1974, 1975, 1976.

U.S. Department of the Interior, National Park Service, Statistical Office, Denver Service Center, Denver, Colorado. National Park Statistical Abstracts, 1980, 1981, 1982, 1983.

U.S. National Park Service. Report of the Director of the National Park Service to the Secretary of the Interior for the Fiscal Year Ended June 30, 1921 and the Travel Season, 1921. Washington, D.C.: Government Printing Office, 1921.

Ward, A.W. "The State of State Road Maps." The American Cartographer 14 (1977):5-9.

Yarnal, Careen M. "The Relationship of Map Design and Map Use in A Recreational Framework." Master's thesis, University of Calgary, 1979.

Wright, J. K. "Map Makers are Human." The Geographical Review 32 (1944):527-44.

Zierer, Clifford M. "Tourism and Recreation in the West." The Geographical Review 42 (1952):462-81.